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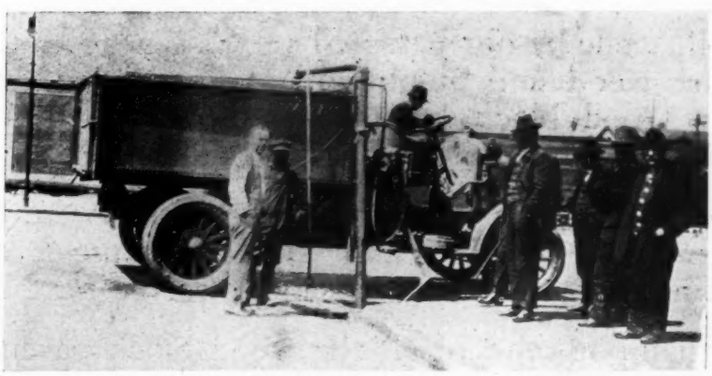

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Municipal Journal

Volume XLIV. NEW YORK, MARCH 16, 1918 No. 11

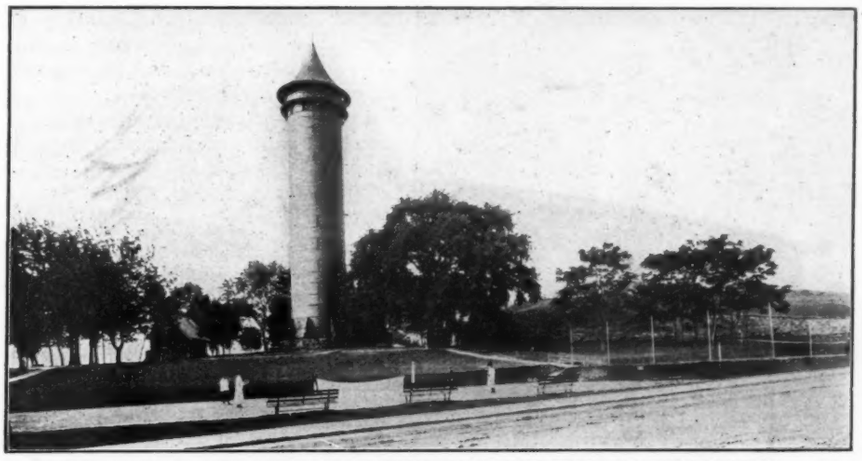
ELECTRIFICATION OF LANCASTER WATER WORKS

Old Steam Plant Built in 1836 Gradually Replaced by More Modern Apparatus—New Electric Plant Has Twenty-one Million Gallons High-Duty Capacity—Description of New Equipment.

By JOHN T. BRAINARD.*

The original pumping plant of the Lancaster, Pa., water works was built in the year 1836, and has developed in size and efficiency from that time until a few months ago, when an electric equipment was installed. Nothing now remains of the machinery of the old water works except a 12,000,000-gallon steam pump and four steam boilers, which will be held in reserve for cases of emergency.

The city obtains its supply from Conestoga creek, which has a water-shed above the city of about 310 square miles and has a minimum flow of about 40,000,000 gallons per day and a maximum flood-flow of 25,000 second-feet. The raw water flows by gravity to low-duty pumps, which raise it to the filter plant. The filter plant has a capacity of nine million gallons per twenty-four hours and is exceeding the bacterial efficiency required, removing 99 per cent and over, and furnishing the city with clear, safe water, regardless of the condition of the creek.



STANDPIPE AND TENNIS COURTS AT EAST END OF RESERVOIR.

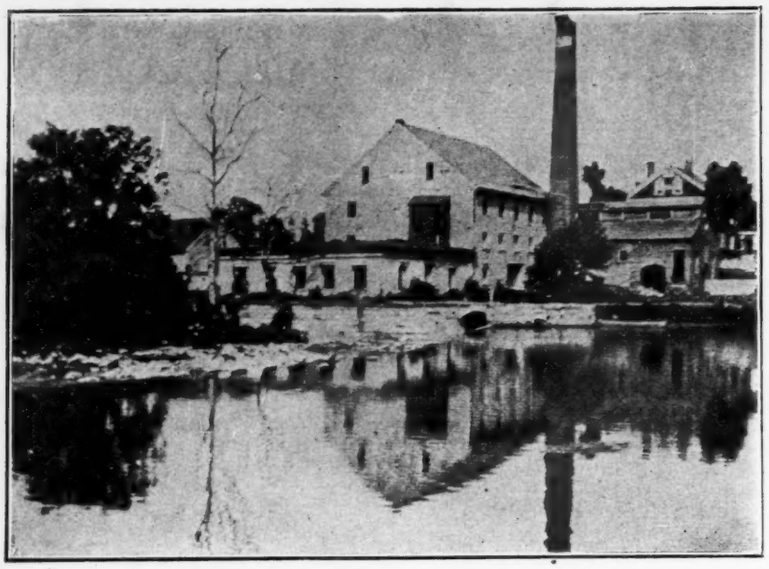
After filtration the water passes to a concrete storage reservoir with a capacity of one and one-half million gallons. From the reservoir, the water is led through a 30-inch main to the pumping station, where high-duty centrifugal pumps, electric-driven, deliver it to a standpipe and reservoirs.

The new pumping machinery consists of five high-duty pumps, three low-duty pumps and two vacuum pumps. All of these were furnished by the Earle Gear & Machine Co. of Philadelphia. The electric motors, which were manufactured by the Westinghouse Electric Mfg. Co., are of the 3-phase, 25-cycle, 55-volt, induction, slip-ring type for the high-duty pumps, and of the squirrel-cage type for the low-duty pumps, machine shop and vacuum pumps. The high-duty pumps are centrifugal, 2-stage, direct-driven type, two of 5,000,000 gallons daily capacity each, two of 4,000,000 gallons each, and one of 3,000,000 gallons, a combined rated daily capacity of 21,000,000 gallons per 24 hours. As a matter of fact, on several occasions the two 4,000,000-gallons pumps alone have delivered 11,000,000 gallons of water in a day. The largest pumps are driven by 300-h. p. motors, the 4,000-gallon pumps by 250-h. p. motors and the smallest pump by a 200-h. p. motor. The pumps work against an average head of 231 feet.

The three low-duty pumps are centrifugal, single-phase and pump water from the receiving basin to the filtration plant against a head of approximately 44 feet. These are driven by one 100-h. p. motor and two 75-h. p. A 10-h. p. motor drives the machinery of the shop and two 1-h. p. motors, direct-connected to two vacuum pumps, serve to prime the low-duty pumps. The eleven motors in the plant aggregate 1,562 h. p.

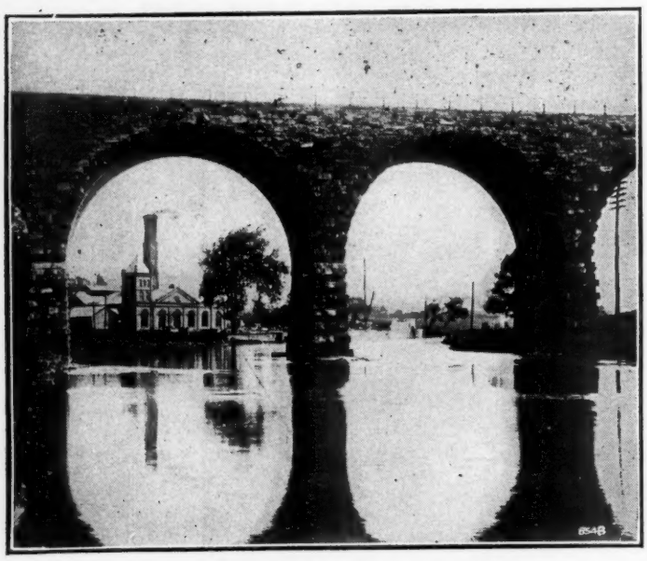
The slip ring motors for the high-duty pumps are started and controlled by Westinghouse magnetic switch-type automatic controllers, which start by cutting resistance out of the secondary of the motor. Interlocks definitely determine the rate at which the motor is

*Secretary, Lancaster, Pa., Water Works.



OLD WATER WORKS, BUILT 1836-7.

brought up to speed. A four-panel board controls the two large pumps and a six-panel board controls the 4,000,000-gallon and 3,000,000-gallon pumps. The control is split to reduce the length of wire from control boards to motor secondaries.



WATER WORKS PUMPING STATION—1917.

The low-duty pumps are started by auto-starters or compensators for reducing primary voltage. The vacuum pumps are started by a single-throw switch. The master circuits to the control for the high-duty-pumps are duplicated in the engineer's quarters and any or all can be started or stopped from that point or from the main board at will.

The energy for the operation of the plant is supplied by the Edison Electric Company and is transmitted from a separate panel at Engleside sub-station by a duplicate 3-phase line which, for a considerable part of the way, is supported on latticed steel towers, run over a right-of-way specially chosen because of its freedom from potential causes of interruptions.

At the entrance to the pumping station grounds is located an iron frame supporting duplicate sets of electrolytic lightning arrestors, with their accompanying choke coils, hook switches and horn gaps. After passing through the choke coils, the energy is brought into the transformer room by duplicate lead-encased high-tension cables.

The transformer room contains four 400-k. v. a. single-phase transformers, 11,000 volt primary and a combination secondary suitable for 2,300 or 575 volts. The present connection is 575 volts. The installation also includes a 10-k. v. a. transformer from 575 to 230—115 volts for lighting the plant and also for lighting a large electric sign on the roof of the plant containing 500 lamps that form the illuminated sign: "Lancaster, Pa. Water Works. Pure Filtered Water."

A panel having ammeters, volt-meter, two graphic and two integrating wattmeters and a circuit breaker, with over-load time limit relays, controls the high tension bus to transformers. A four-panel board controls the three power circuits and the lighting circuits. Each power panel has a separate circuit breaker with over-load and no-voltage trip and graphic recording watt meter. One panel controls the 300-h. p. pumps, another the remaining three high-lift pumps, and one is for the low-duty pumps, machine shop and vacuum pumps. The lighting panel has standard 250 volt knife switches fused on front of board with cartridge fuses.

At the East End reservoir is a 10,000,000-gallon centrifugal pump furnished by the International Pump Co., driven by a General Electric Co. motor which is used, in case of a shut-down at the main pumping station, to pump water from the low reservoirs to the standpipe or high-service mains.

The amount of water pumped during the year 1916 was 2,679,370,000 gallons, while for 1917, the pumpage was 2,552,720,000 gallons, a decrease of 126,650,000 gallons. Last year's pumpage is the smallest that we have had in any year since 1910, when it was 2,567,424,000. The decrease can be attributed to the installation of water meters and the general inspection of the city by five inspectors who are on the look-out for any leaking service mains and faulty plumbing. The charge for water is 5c per thousand gallons by meter, or an average flat rate of $10 a year and waste as much as you like.

RESERVOIR AND FILTER PLANT—1917.

Much work remains to be done at the main pumping station in the way of interior repairs, which are now being attended to. The entire work has been under the direct supervision of the superintendent, C. K. Will, and the operation of the pumps is under the direction of the operating engineer, John C. Coyle.

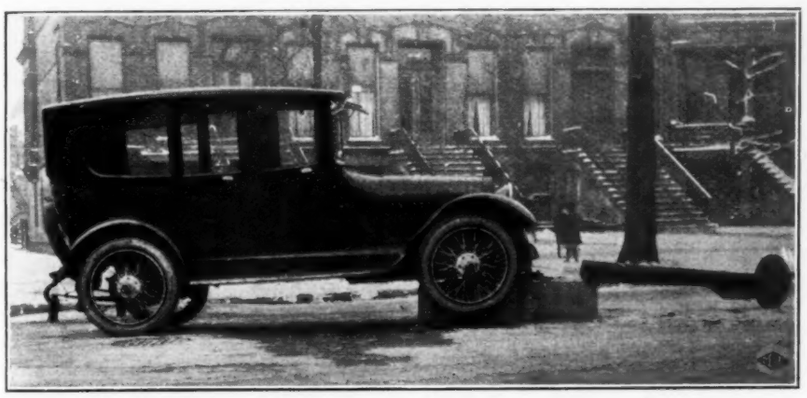
DANGEROUS "SAFETY" ISLANDS.

Accidents Caused by Low Visibility of Lamp Posts and Poor Shape of Islands—Plan Proposed for Minimizing Danger.

By G. S. EATON.

Safety islands, so called, are provided in the centers of numerous streets in many large cities for two purposes—to offer adequate protection to pedestrians who must cross automobile thoroughfares; and, by fixing lines of traffic as well as by indicating danger points, to minimize collisions and congestion.

On heavily traveled boulevards and streets where motor cars move at high speeds, safety islands may be needed to control traffic even more than to protect pedestrians. Without them a reckless chauffeur may cut across diagonally in front of other machines when turning into an intersecting street and endanger the lives of others as well as his own.



SAFETY ISLAND LAMP POST DESTROYED BY HEAD-ON COLLISION.
Jackson Boulevard and Ashland Boulevard, Chicago.

The use of safety islands dates back only a few years. In the short period since the development of motor car traffic has made their adoption necessary, there has been but little consideration given to ways of reducing the danger which is introduced whenever such a barrier is placed at the center of a much-used pavement.

Much of the danger now connected with safety islands at street intersections must be eliminated before the name is truly descriptive. For both the motorist and the pedestrian, an island of safety as usually constructed has dangerous features. Considerations of safety make urgent the direction of effort toward increasing the visibility of islands and so shaping them as to minimize the effect of collisions.

A short tour made some weeks ago over a few of Chicago's north side boulevards showed two broken island lamp posts. It had been necessary to replace both platform and base of a third island a few days before.

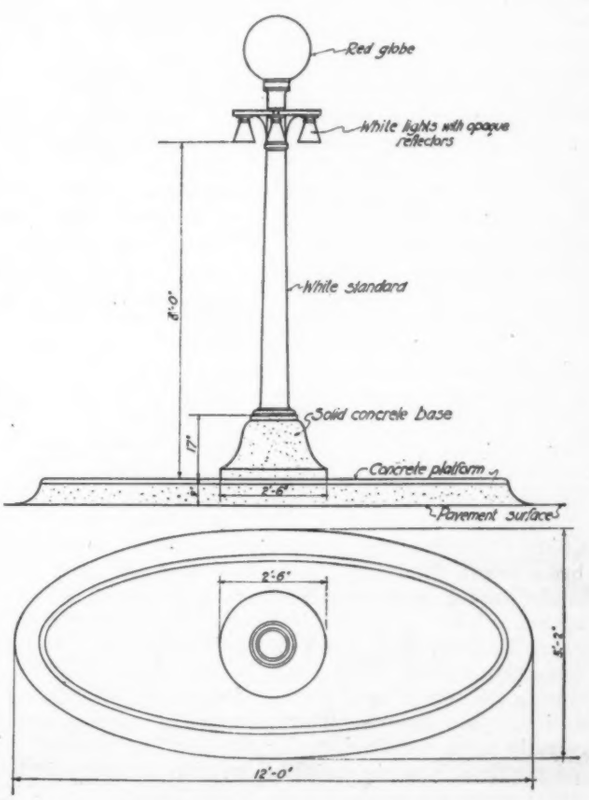
At the 153 safety islands under the jurisdiction of the South Park Commissioners, Chicago, 270 accidents occurred in one year, according to J. F. Foster, general superintendent. These accidents ranged from some in which only the electric light globe was broken to those in which automobile, lamp post and even platform were wrecked.

One of the many accidents occuring to islands under the jurisdiction of the West Chicago Park Commissioners is seen in the photograph showing an automobile with its hood resting on an island platform. The action of the South Park Commissioners, and just recently of the Lincoln Park Commissioners, in having their island lamp posts painted white to give greater visibility, has not yet been followed on the West Side.

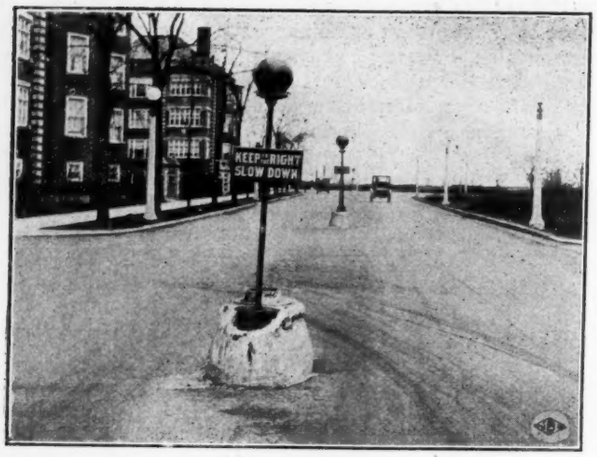
Failure to foresee how an island a block away will appear to the motorist as he approaches it at night has been responsible for many of these collisions. Instead of finding before him a black post almost invisible, rising from a platform of indeterminate extent, he should see a white post and base well illuminated. There must be no glare to blind him. Small white lights shielded by opaque reflectors just below the red signal will furnish the illumination needed. On top, a red globe, adequately lighted, will warn the driver of danger and remind him to keep to the right and slow down.

Painting island lamp posts white was first done in Chicago last summer when the South Park Commissioners adopted that practice in order to make islands more plainly visible. With the dark background against which the motorist usually sees the islands, it is only in foggy weather that a dark object might be more easily seen. In this case, the red globe will furnish the dark color.

A white globe with red bulbs within has not proved desirable, nor has the two-color globe—red above and white below—which has been used in an endeavor to illuminate the island adequately. Even though the island is well lighted, an automobile may be forced into it to avoid collision with a recklessly driven car or with a pedestrian. On slippery pavements, skidding into the platform is responsible for many accidents. Shaping the island so that it will turn aside any but a car hitting it head-on will be effective in promoting safety. An automobile striking the island squarely must be stopped if the pedestrian seeking refuge there is to be protected. Experience has shown the necessity of setting



PLAN FOR ISLAND OF SAFETY.



BASE AND POST BROKEN; TEMPORARY POST IN PLACE.
Sheridan Road and Belmont Ave., Chicago.

the platform well into the pavement; otherwise, a heavy car may displace the whole island.

Shape, color and illumination, then, are important features in safety island design. Thought was given to these points in working up the accompanying drawing, which serves to illustrate the design of a safe island of safety.

—— Buy War Saving Stamps ——

GARBAGE COLLECTION IN CHICAGO.

Qualities Desired in Cans and Wagons—Practice in Chicago—Water Carriage of Garbage—Keep Handling at a Minimum.

A paper on "Refuse Disposal," read a few weeks ago by Rudolph Hering before the Western Society of Engineers, led to further discussion of the subject by other members, in the course of which Col. Henry A. Allen had the following to say concerning refuse collection and disposal in Chicago:

"It is a fact, as Mr. Hering has said, that the most difficult part of the problem is getting the garbage from the householder into the collecting wagon. The question of the collecting wagon itself and transporting it from there to the disposal works are comparatively simple matters, just plain questions of engineering, keeping in mind unit costs. The question of getting the garbage from the householders to the wagons, however, is a difficult engineering problem. It is the more so as cities are not laid out so that uniform collection apparatus can be used in all sections. Sometimes we have paved streets, sometimes not paved. Sometimes we have alleys, sometimes no alleys. Therefore, up to the present it has been impossible to design a universal, up-to-date garbage box.

"In the selection of a garbage can, its adaptability to be readily loaded onto collecting wagon, or its contents dumped therein, must be given consideration. The size of the collecting box is most important, as, other things being equal, the larger the capacity and the more readily loaded, the greater the efficiency of the entire collecting system. Various types of wagons have been gotten up, several arranged to work in conjunction with the garbage can, so that the garbage is kept entirely from sight during the receiving of garbage from can and in transportation. Just how far this principle is carried depends greatly upon the time during the day that the collection of garbage is made and also on the number of collections made per week. When collections are made three or four times a week very little offense will result, whereas if less often and in hot weather the garbage will emit very offensive odors.

"We tried in Chicago to use a 6-cubic yard box, the reason being that our present garbage box holds about four cubic yards, and rubbish wagons five cubic yards. A 6-cubic yard box would mean a 50 per cent increase in capacity for each single load in the case of garbage and 20 per cent increase in the case of rubbish. But when taking into consideration that only 18 per cent of the alleys are paved and about 60 per cent of the streets, we decided that a 4½-cubic yard box would be the best all-around and convenient size. The larger box would require the use of 3-horse teams in many parts of the city. It would be rather difficult to handle 3-horse teams in many of our narrow alleys. The idea was to design a standard collecting unit that would not only handle garbage, rubbish and ashes, but also night soil, street sweepings, sewer cleanings, manure and material of a similar nature. The result would be the standardization of equipment, such as wagons, motor trucks, barges and handling equipment.

"The Chicago river and the Sanitary District canal are well located for convenient handling of a large portion of the various municipal wastes. The city has one loading station at Chicago avenue (which it is expected soon to move to Goose island), where it is proposed to erect a large loading station for the handling of garbage, rubbish, ashes and manure. We are endeavoring to make this an up-to-date loading station. Another loading station is situated on the North Branch of the Chicago river on Oakley avenue near Diversey street. It is the intention to erect two additional loading stations on the Chicago river or the north branch of the Sanitary District canal to take advantage of water transportation. It is possible that two other stations may be situated on the Sanitary District canal near 14th street and California avenue. These stations will also be convenient for barge service.

"In a paper I read before the American Society of Mechanical Engineers, I made the statement that I considered the following to be an axiom, referring to the handling of offensive substances, namely: that that system of handling offensive substances which exposes the least amount of surface to contact with such substances will be the least offensive, the most sanitary and in the greater number of cases practically the least costly in operation. This idea would mean the keeping of the garbage in the collecting box until final disposition; not dumping it in bins and then re-handling it. In other words, to unload the boxes on reaching the reduction plant but not to dump from the boxes until ready to run it directly through the reduction apparatus. This means an additional number of boxes but the production of less offense at the plant and the saving of a considerable amount of labor. Garbage dumped into pits is very difficult to handle because of matting. In fact, it seems to violate all reasonable rules of mechanics relating to the flow of materials."

—— Buy War Saving Stamps ——

DISINFECTION IN PHILADELPHIA.

In the operation of the Pennypack creek sewage treatment works in Philadelphia (described in Municipal Journal for February 1st, 1912) the sewage, after passing through Inhoff tanks and sprinkling filters, is disinfected before being discharged into the Delaware river. Considering this treatment, the report for the year 1916 gives the following information:

"Owing to the condition of the market it was inadvisable to use bleaching powder this year. A liquid chlorine

apparatus was secured and placed in operation on February 8th.

"It was possible to obtain a practically sterile effluent when from 18 to 20 pounds of 35 per cent available chlorine 'bleach' was used per million gallons of trickling filter effluent. But, with the liquid chlorine, it was found that even with proportionately larger amounts of gas it was very seldom that B. coli were not present in the final effluent.

"It is well known that the action of liquid chlorine is much more rapid than calcium hypochlorite, and this led to the thought that only the outside of appreciable-sized particles were being sterilized, while the interior remained unaffected.

"An attempt to slow down the action of the gas by adding lime water to the sewage in advance of the application of the chlorinated water gave a slight improvement. Beginning May 25th, lime water and chlorinated water were mixed in a small baffled tank and fed to the constant-head orifice tank. Using 6 pounds of chlorine gas and 8 pounds of lime a day has made a solution of such strength that about ½ part per million available chlorine is being added to the sewage, and the results obtained are nearly as reliable as when bleaching powder was used to make the disinfecting solution."

—— Buy War Saving Stamps ——

SEWERAGE TERMS.

Recommended for Adoption as Standard by Committee of American Public Health Association—Includes Sewerage and Sewage Disposal.

The following terms and definitions are suggested as standards for general use in connection with sewerage and sewage disposal practice, having been prepared by the Committee on Sewerage and Sewage Disposal of the American Public Health Association. This committee consists of Kenneth Allen, engineer of sewer design to the Board of Estimate and Apportionment of New York; Frank A. Barbour, sanitary engineer, Boston; Harrison P. Eddy, sanitary engineer, Boston; Langdon Pearse, division engineer in charge of sewage disposal investigation, Sanitary District, Chicago, and George S. Webster, chairman, director, Department of Wharves, Docks and Ferries, Philadelphia. Comments upon the terms are given on the editorial page.

Definitions of Terms Used in Sewerage and Sewage Disposal Practice.

Recommended by Committee on Sewerage and Sewage Disposal of the American Public Health Association.

SEWERAGE AND DRAINAGE.

1. SEWAGE.

Sewage is a combination of the liquid wastes conducted away from residences, business buildings and institutions, together with those from industrial establishments; and with such ground, surface and storm water as may be present.

(a) *Domestic Sewage* is that from residences, business buildings or institutions.

*(b) *Industrial Wastes* are the liquid wastes resulting from the processes employed in industrial establishments.

*In the opinion of the committee, the term "Industrial Wastes" is preferable to "Trade Wastes."

2. DRAINAGE.

(a) *Surface Water* is that portion of the precipitation which runs off over the surface of the ground.

(b) *Storm Water* is that portion of the precipitation which runs off over the surface during a storm and for such a short period following a storm as the flow exceeds the normal or ordinary run-off.

(c) *Ground Water* is that which is standing in, or passing through, the ground.

3. SEWERS.

A *Sewer* is a conduit for carrying off sewage.

(a) A *Common Sewer* is a sewer in which all abuttors have equal rights of entrance and use.

(b) A *House Connection* is a pipe leading from a building to a common sewer.

(c) A *Lateral Sewer* is a sewer which does not receive the sewage from any other common sewer.

†The committee is of the opinion that preference should be given to the term "Sub-main Sewer" rather than to "Branch Sewer."

†(d) A *Sub-main* or *Branch Sewer* is a sewer into which the sewage from two or more lateral sewers is discharged.

(e) A *Main* or *Trunk Sewer* is a sewer into which the sewage from two or more sub-main sewers is discharged.

(f) An *Outfall Sewer* is a sewer extending from the lower end of the collecting system to the point of final discharge into a body of water or to a sewage treatment plant.

**In the opinion of the committee, the use of the term "Separate Sewer" is preferable to "Sanitary Sewer," which latter term should be discontinued.

**(g) A *Separate Sewer* is a sewer intended to receive domestic sewage and industrial wastes without the admixture of surface or storm water.

(h) A *Combined Sewer* is a sewer intended to receive domestic sewage, industrial wastes and surface and storm water.

(i) An *Intercepting Sewer* is a sewer generally laid transversely to the general sewer system to intercept all the sewage collected by the sewers of a separate system, or the dry weather flow of sewage and such additional surface and storm water as may be determined from a combined system.

(j) A *Relief Sewer* is a sewer designed to carry a portion of the flow from a district already provided with sewers of insufficient capacity, and thus prevent overtaxing the latter.

(k) A *Storm Water Overflow Sewer* is a sewer designed to carry the excess over a certain volume of combined sewage from a main or intercepting sewer to an independent outlet.

4. DRAIN.

A *Drain* is a conduit for carrying off storm water, surface water, sub-soil or ground water.

(a) A *Storm Drain* is a conduit for carrying off surface and storm water.

(b) A *Land Drain* is a conduit for carrying off sub-soil or ground water, and for draining land.

5. SEWER SYSTEM.

A *Sewer System* is the collecting system of sewers and appurtenances, together with such small pumping stations as may be required to lift the sewage from low-level districts.

(a) A *Combined System* is a system of combined sewers.

(b) A *Separate System* is a system of separate sewers.

6. SEWERAGE WORKS.

Sewerage Works comprise the sewer system, main pumping stations, treatment works, means of disposal of effluent and sludge, and all other works necessary to the complete collection, treatment and disposal of the sewage.

7. SEWER APPURTENANCES.*

(a) A *Manhole* is a shaft or chamber leading from the surface of the ground to the sewer, large enough to enable a man to gain access to the latter.

(b) A *Lamphole* is a small vertical pipe or shaft leading from the surface of the ground to the sewer, for admitting a lantern or reflected light for purposes of inspection.

(c) A *Wellhole* or *Drop Manhole* is a vertical shaft in which sewage is allowed to fall from one sewer to another at a lower level.

(d) An *Inlet* is a connection between the surface of the ground and a combined sewer or drain for the admission of surface or storm water.

(e) A *Catch Basin* is a chamber inserted in an inlet to prevent the admission of grit and other coarse material into the sewer or drain.

(f) A *Flush Tank* is a tank in which water or sewage is accumulated to be quickly discharged later, for the purpose of flushing the sewer.

(g) A *Regulator* is a device for controlling the quantity of sewage admitted to an intercepting sewer.

(h) An *Outlet* is the end of a sewer or drain from which its contents are finally discharged.

(i) A *Storm Overflow* is a weir, orifice, or other device for permitting the discharge from a combined sewer of that portion of the storm flow in excess of that which the sewer is designed to carry.

SEWAGE DISPOSAL.

8. GENERAL TERMS.

(a) *Sewage Disposal* is a generic term applied to the act of disposing of sewage by any method.

*Drain-structures similar to those defined under sewer system, sewerage works and sewer appurtenances are to have like names and definitions.

*(b) *Sewage Treatment* is the process to which sewage is subjected in order to partially remove its impurities or so change them as to render the effluent fit for final discharge.

(c) *Contamination* is the introduction into a water of bacteria or other substances which tend to render it unsuitable for domestic use.

(d) *Pollution* is the introduction into a water of substances of such character and in such quantity that they tend to render the body of water or river objectionable in appearance, or to cause it to give off objectionable odors.

(e) *Influent* is sewage, or partially treated sewage, flowing into any sewage treatment device.

(f) *Effluent* is partially or completely treated sewage flowing out of any sewage treatment device.

(g) *Putrescibility* is the susceptibility of sewage, effluent, or wet sludge, to putrefaction under the conditions to which it is subjected.

(h) *Stability* is the capability of sewage or effluent to resist putrefaction under the conditions to which it is subjected.

(i) *Relative Stability* is the ratio of available oxygen to the oxygen required to prevent putrefaction, expressed in per cent.

(j) *Suspended Solids* are those which are removed from sewage or effluent by standard laboratory methods of filtration.

(k) *Settling Solids* are those suspended matters which will subside in quiescent sewage in two hours.

(l) *Clarification* is a relative term denoting the partial removal of suspended and colloidal matter by straining, sedimentation, or by coagulation and sedimentation.

(m) *Colloidal Matter* (conveniently defined) is the suspended matter which is so finely divided that it will not subside in two hours, yet will not pass through a parchment membrane in the ordinary process of dialysis.

9. SCREENING.

A *Screen* is a device containing openings of proper size to retain a part of the suspended matter of sewage.

(a) A *Coarse Screen* is one having openings in excess of one inch in least dimension.

(b) A *Fine Screen* is one having openings of one-fourth inch, or less, in least dimension.

(c) A *Medium Screen* is one having openings intermediate between a coarse screen and a fine screen.

(d) A *Bar Screen* is one composed of parallel bars or rods.

(e) A *Mesh Screen* is one composed of a fabric, usually of wire.

(f) A *Grating* consists of two sets of parallel bars in the same plane, the sets intersecting at right angles.

(g) A *Band Screen* is one consisting of an endless band or belt of wire mesh or other screening material which passes over upper and lower rollers.

(h) A *Wing Screen* is one having radial or curved vanes, usually composed of uniformly spaced bars, which rotate on a horizontal axis.

(i) A *Drum Screen* is one in the form of a cylinder or cone, consisting of perforated plates or a wire mesh which rotates on an approximately horizontal axis.

(j) A *Disc Screen* consists of a rotating circular perforated disc, with or without a concentric truncated cone of similar material.

(k) A *Cage Screen* consists of a cage, usually with sides of parallel bars or rods, so arranged that it may be lowered into the sewage and raised therefrom for cleaning.

10. TANK TREATMENT.

Tank Treatment is the detention of sewage or sewage sludge in tanks, either quiescent or with continuous flow.

(a) A *Grit Chamber* is a chamber or enlarged channel in which the cross-section is so designed that the velocity is such that only heavy solids, such as grit and sand, are deposited, while the lighter organic solids are carried forward in suspension.

(b) A *Sedimentation Tank* is a tank for the partial removal of suspended matter, either by quiescent settlement, or by continuous flow at such a velocity and time of retention as to allow deposition of suspended matter.

(c) A *Dortmund Tank* is a vertical sedimentation tank, usually cylindrical above and with a conical or hopper-shaped bottom, into which the sewage or partially treated sewage is introduced near the center and after rising through the tank passes out at the surface—the sludge being drawn off, without emptying the tank, before it becomes septic.

(d) A *Hydrolytic Tank* is a sedimentation tank in which, by biological processes, a portion of the suspended matter is converted into liquid and gaseous form.

(e) A *Septic Tank* is a horizontal, continuous-flow, one-story hydrolytic tank in which the suspended matter is retained until anaerobic decomposition is to a considerable extent effected.

(f) A *Travis Tank* is a two-story hydrolytic tank consisting of an upper, or sedimentation chamber, with steeply sloping bottom, terminating in one or more slots through which the solids may slide as deposited into the lower or sludge digestion chamber, through which a predetermined portion of the sewage is allowed to pass for the purpose of seeding and maintaining bacterial life in the sludge and carrying away decomposition products, thus inducing digestion of the sludge attended by its reduction in volume.

(g) An *Imhoff Tank* is a two-story hydrolytic tank, consisting of an upper, or sedimentation chamber, with steeply sloping bottom, terminating in one or more slots through which the solids may slide as deposited into the lower or sludge digestion chamber—these slots being trapped so as to prevent the rise of gas and solids from the lower chamber—the lower chamber being provided with vents for the escape of the gases, the tank being so constructed as to facilitate the passage of the sewage quickly through the upper chamber and prevent the flow of sewage through the digestion chamber, and intended to be so operated that the sludge may be thoroughly decomposed, rendered practically free from offensive odor and so filled with gas that it can readily be drawn off and dried.

(h) *Activated Sludge Process* is the agitation of a mixture of sewage with about 15 per cent or more of its volume of biologically active liquid sludge in the presence of ample atmospheric oxygen, for a sufficient period of time at least to coagulate a large proportion of the colloidal substances, followed by sedimentation adequate for the subsidence of the sludge flocculi; the activated sludge having been previously produced by aeration of successive portions of sewage and maintained in its active condition by adequate aeration by itself or in contact with sewage.

(i) *Chemical Precipitation* is the addition to, and thorough mixing with, the sewage of such chemicals as will, by reaction with each other or with the ingredients of the sewage, produce a flocculent precipitant; and subsequent sedimentation.

11. SLUDGE DISPOSAL.

Sludge is the suspended solids of the sewage deposited in tanks or intercepted at the surface of filters, mixed with more or less water.

(a) *Sludge Digestion* is the biological process by which organic matter in sludge is gasified, liquefied, mineralized, or converted into stable organic matter.

(b) *Separate Sludge Digestion* is the digestion of sludge in tanks entirely independent from the tanks in which it is produced.

(c) A *Sludge Drying Bed* is a natural or artificial layer of porous material upon which sludge is dried by drainage and evaporation.

(d) *Sludge Concentration* is the process of reducing the volume of sludge and increasing its proportion of solids by allowing it to stand in a suitable tank until the solids settle down, and drawing off the relatively clean water at the top.

(e) *Sludge Drying* is the process of drying sludge by drainage and evaporation.

(f) *Sludge Dewatering* is the process of removing a portion of the water contained in the sludge by draining, pressing, centrifuging, or by other natural or mechanical processes.

(g) *Sludge Pressing* is the process of dewatering by subjection to pressure, the solids being retained by a cloth fabric which permits the water to pass through it.

(h) *Sludge Cake* is the mass of dewatered sludge resulting from sludge pressing.

(i) *Commercially Dry Sludge* is sludge containing not more than ten per cent of water.

12. MISCELLANEOUS.

(a) *Scum* is a mass of sewage solids, buoyed up in part by entrained gas or grease, and which consequently floats at the surface of the sewage.

(b) *Screenings* constitute the material removed from sewage by screens.

(c) *Grit* is the heavy mineral matter deposited from sewage.

(d) *Sleek* is the oily film of microscopic thickness present on the surface of waters about, and often extending a considerable distance from, sewer outlets.

13. SEWAGE OXIDATION.

Sewage Oxidation is the process whereby, through the agency of living organisms in the presence of air, the organic matter is converted to a more stable condition or into mineral matter.

(a) *Irrigation* is the process of sewage treatment in which the sewage is applied to land for the primary purpose of purifying the sewage and the secondary purposes of supplying water and fertilizer to crops.

*The term "Sewage Purification" should be abandoned.

(b) *Surface Irrigation* is the process in which sewage is applied to and distributed over the surface of cropped ground.

(c) *Sub-surface Irrigation* is the process in which sewage is distributed beneath the surface of the ground by means of open-jointed pipes.

(d) An *Intermittent Filter* is a natural or artificial bed of sand or other fine-grained material to which sewage is intermittently applied in doses, and which by its capillarity holds the sewage for a time sufficiently long, in the presence of air, to effect by biological processes a high degree of purification.

(e) A *Contact Bed* is a water-tight basin filled with coarse material, such as broken stone, in contact with which the sewage is for a time held by control of the underdrains—the cycle of operation involving periods of filling, standing full, emptying,and resting empty; so regulated as to secure such contact with the bacterial films adhering to the surface of the coarse material, and such aeration of the bacterial surfaces, as may be required to oxidize the sewage.

(f) A *Slate Bed* is a water-tight tank filled with slabs of slate or other similar material, laid horizontally and spaced an inch or more apart vertically, equipped so that it may be filled with sewage, allowed to stand full for a definite period of time, drained and allowed to stand empty for a time, for the purpose of oxidizing the organic matter deposited upon and adhering to the slates.

*(g) A *Trickling Filter* is an artificial bed of coarse material, such as crushed stone or clinkers, over which the sewage is distributed as a spray from fixed nozzles or as a film from moving distributors, through which it trickles to the underdrain system, coming in contact with the bacterial films adhering to the surface of the stones, and in which such aeration of the bacterial surface as may be required to oxidize the sewage is afforded.

*The committee is of the opinion that the term "Trickling Filter" is preferable to the term "Sprinkling Filter" or "Percolating Filter," which are frequently used as synonymous terms.

(h) A *Dosing Apparatus* is the apparatus used for regulating the application of sewage to filters or for applying the required quantity of chemicals to sewage.

(i) A *Dosing Tank* is a tank into which raw or partially treated sewage is introduced and held until the desired quantity has been accumulated, and then discharged at such a rate as is necessary for the distribution essential to the subsequent treatment.

(j) A *Sprinkler Nozzle* is a nozzle used for applying sewage in the form of a spray to trickling filters.

(k) A *Distributor* is a movable perforated pipe, channel or water wheel which distributes sewage upon the surface of a trickling filter. There are two types of distributors—the rotary and the traveling; the rotary moves about a central axis with delivery to a circular filter; the traveling moves back and forth the length of a rectangular filter.

14. DISINFECTION.

Disinfection is the destruction, by the agency of some chemical, of a large percentage of the bacteria in sewage or contaminated water, so as to materially reduce the danger of infection.

15. STERILIZATION.

Sterilization is the destruction, by the agency of some chemical, of all the bacteria in sewage or contaminated water, including their spores.

CAMBRIDGE WATER WORKS NOTES.

Cambridge, Mass., with a population of about 115,000, purchased a private water works plant in 1865, from which has been developed its present system. The original source of supply was Fresh Pond, to which was added, in 1887, a storage reservoir on Stony Brook, from which the water is led to Fresh Pond. In 1897, two large storage reservoirs were formed by dams across Hobbs Brook. The water flows by gravity from the Hobbs Brook and Stony Brook storage reservoirs to Fresh Pond receiving reservoir, and is pumped from this to Payson Park distributing reservoir, from which it flows by gravity to the city.

Fishing in Fresh Pond is permitted to those who obtain permits for this, but is allowed only during the day-time from May to October, inclusive, and everyone using a permit must be accompanied in the boat by an employee as a sanitary supervisor.

At both Fresh Pond and Stony Brook reservoirs, standing grass on the cleared lands of the water-sheds is sold by auction for hay.

The water-shed of Stony Brook reservoir contains a number of residences, and in order to protect the supply, the city has built on this shed 37 cesspools and 19 vaults. During the year covered by the 1917 report, 638,950 gallons of sewage and 59 barrels of solids were removed from the vaults and cesspools by the city.

Owing largely to the considerable age of a part of the distributing system, there is still an undesirable amount of 4-inch pipe in use, this totaling about 16 miles, while there is about two miles of 2-inch and 3-inch mains. These are being replaced by larger pipes as rapidly as possible. Another objectionable feature of the distribution system, which is not so easily eliminated, is that of the dead-ends which seem to be necessitated by the number of courts and private ways into which such dead-ends are laid.

The water department maintains 28 fountains, of which 8 are ice-water fountains. The maintenance of these 8 fountains cost for the last fiscal year $623.64, or $.79 per day per fountain, the greater part of this being for the ice used.

The above information is taken from the 1917 report of Ed. W. Quinn, general superintendent of water works.

TRAINING FIREMEN FOR SERVICE

Special Training Necessary to Make Efficient Firemen—Use of Apparatus, Physical Drill, Administration, Fire Prevention Among Subjects to Be Taught.

In reporting upon the fire department of Indianapolis for the Chamber of Commerce of that city, the New York Bureau of Municipal Research gave the following advice concerning the training of firemen that is applicable to all cities of considerable size, and the principles of which should be adopted by smaller ones as well.

It is now well understood by fire experts that something more is required of an efficient fireman than a good physique and ability to "eat smoke." Special training is required for every step in a fireman's work. Since methods of fire control and extinguishment have practically been standardized, the training of men in the art of putting out fires is no longer a difficult matter and its need is no longer questioned.

Even the ability to extinguish fires promptly with a minimum loss is not all that is necessary to make an efficient fireman. He should also be especially trained to prevent fires by careful inspection and warn householders against common practices conducive to fire, and he should be familiar with every modern equipment for adequate fire prevention.

Provision should be made immediately for the establishment of a training school for firemen which should be under the supervision of one of the assistant chiefs or some member of the department selected because of his special fitness for this service. It would be profitable to have one or more members of the department visit and attend the fire college maintained by the fire department of New York City for a period long enough to familiarize themselves with the methods employed in the conduct of such a school.

The school when established should give courses not only for newly appointed men but also for the present

members of the force and the commanding officers as well. The course of study should include:

1. Practical instruction in the following:
   a. Connecting line of hose.
   b. Use of different sizes of hose.
   c. Use of different nozzles.
   d. Stretching different lines of hose through buildings and up the exterior to the roof.
   e. Skillful handling of hose to secure the maximum efficiency of the stream and to reduce loss from bursting hose.
   f. Use of different couplings and connections.
   g. Handling of ladders, including climbing and scaling ladders.
   h. Handling and using of hooks, picks, door-openers and wire cutters.
   i. Emergency repairs to hose (use of jacket).
   j. Tying knots used in the handling of ladders, lines of hose and other equipment.
   k. Taking out broken links of hose already stretched on the outside of buildings.
   l. Use of chemical tanks.
   m. Use of fire helmets and life nets.
2. Administration:
   a. Discipline (respect for authority).
   b. Reports and records.
   c. Responsibility for city property.
   d. Rules and regulations.
   e. Laws and ordinances concerning fire.
   f. Building by-laws.
3. Physical drill:
   a. Setting-up exercises.
   b. Physical appearance.
4. Lectures on the following:
   a. Building by-laws.
   b. Dangerous fires in general.
   c. Precautions to be taken in emptying burning buildings.
   d. General fire fighting.
   e. Care of apparatus and equipment.
   f. Combustibles and explosives.
   g. Sprinklers and standpipes.
   h. Conservation of property in burning buildings.
   i. Auxiliary fire appliance, including special additional appliances.
   j. Water pressure systems (fire hydrants).
   k. Mains.
   l. Different building constructions.
   m. Duties of firemen in public theaters and places of public assembly.
   n. Fire preventions.
   o. Fire prevention law and by-laws.
   p. Records and reports.
   q. Hygiene and first aid to the injured.
   r. General discipline.

The period of instruction in the school should be not less than three weeks and as long thereafter as is necessary in the individual case. This school should be used to test the fitness of the recruits for fire service as well as to afford adequate training. When not in attendance at school, the recruits should be required to perform actual service with their companies.

The first step in the development of a course of instruction should be to provide for complete training of the commanding officers in order that they will be qualified to conduct drills in their fire houses.

As a means for providing instruction in practical methods employed at fires there should be established as speedily as possible a Pompier training tower. While such a tower should be completely equipped for training purposes, it need not be of any special type of construction.

When men are in attendance at the school, at least one automobile should be stationed there in order to provide for the prompt transportation of the men to a second alarm fire.

Text-books upon the subject of fire fighting should be secured and placed at disposal of the firemen in each fire station. They should be assigned regular lessons and required to study from time to time and be examined as to their knowledge of the subjects studied.

The firemen should receive instructions daily at the stations. The captain should be held strictly responsible for this. A definite course of instruction to be given by the captain at the stations should be provided. The instruction should not consist merely of what are ordinarily termed company drills, which are invariably conducted during fine weather.

The captains should be required to conduct lectures with respect to the important or extra hazardous risks in their districts. As many as possible of the firemen should be required to inspect such risks with a view to being able to discuss at the fire stations the general condition of the buildings and the methods which should be employed should a fire occur therein.

It is very important that the firemen should become thoroughly familiar with the structure and condition of buildings to which they may be called to extinguish fires. No better means of acquiring this knowledge can be suggested than that the men inspect the property and be required to discuss with their officers and other men in the company the conditions observed. To do this successfully it is necessary that the firemen be provided with a suitable printed form on which to report their observations. That is not the practice at present. It would be of great profit to the firemen themselves and to the city if the firemen would spend their time when on duty in study and in discussing their work rather than remain idle for a greater part of the time as at present.

The education of a fireman can never be said to be adequate until he has received not only scientific training but actual service in all branches of the department. Consequently, every fireman should perform service in hose companies, engine companies, truck companies and chemical companies. His education by reason of experience gained in these various branches of the service should make him competent to handle any piece of apparatus even to the extent of operating the steam engine. There is no logical reason why every man in an engine company should not, in time, be competent to serve as an engineer, and the same is true with respect to the driving of apparatus. There should be no titles or grades which would make any distinction between a fireman assigned to an engine company and one in a ladder or a hose company. Each should be rated as a fireman.

In order that firemen shall have the opportunity to acquire the broadest experience it is recommended that the chief from time to time transfer the members from one company to another, thus requiring a man who has served for a reasonable period in an engine company to perform service for a similar period with a truck company. It is not suggested that this system carry with it any wholesale periodic transfers, but rather that transfers be made as a result of a carefully worked out schedule so as to cause the least hardship to the members. A practical method is to cause the transfers to be first made within districts and upon the recommendation of district chiefs. After a fireman has performed various services in one district he should be given an opportunity in another district.

There are many instances on record of fires in hotels, office buildings and the like where the elevator operators were among the first to desert the building, thus cutting off a means of escape for the people located on the upper stories. Moreover, there are times when an elevator in a building can be used to good advantage in distributing the firemen throughout the building. For this reason it is necessary that firemen receive instructions in the operation of elevators as part of their training. It is therefore recommended that immediate arrangements to this end be made by the chief.

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STANDARD SEWERAGE TERMS AND UNIFORM DEFINITIONS.

Every branch of science, as it develops, finds the need for new words that must be coined to express new ideas, and in many cases different words are used to express more or less loosely the same ideas. Exactness and facility of statement require that a definite and precise meaning of each term used be adopted and generally accepted, and it is also desirable that but one word be used to express the same idea.

Among the various branches of engineering there is perhaps none that more urgently needs such standardizing than does sewerage; although the standardizing of road construction terms also is much to be desired. (A list of "terms for use in referring to highway work" proposed by the American Society of Civil Engineers was given in our issue of March 4th, 1915.) In this issue we publish a list of sewerage terms proposed by a committee of the American Public Health Association, together with definitions of terms in common use but the exact meanings assigned to which are more or less vague.

We hope that all who are interested in sewerage will examine this list carefully, and criticize those terms and definitions with which they do not agree. Our columns are open to such criticisms, and we hope that all who have any to offer will contribute to a discussion of the matter. If any of the terms do not find general acceptance, it is greatly to be desired that others be proposed that will; otherwise the present confusion will continue.

The terms which appear to us most open to criticism, as defined, are "sewage," "sewer" and "drain." The last would apply to a conduit provided for carrying a creek or to one for draining out farm land, as well as to one for carrying the run-off from street surfaces; "sewer" would be confined to a conduit for carrying the waste water from buildings "with such ground, surface and storm water as may be present." A conduit that is built to carry all the storm water and the wastes from buildings as well is a sewer, but one built in the same way and of practically the same size and located under city streets is not a sewer if no waste water from buildings enters it. If a combined sewer is a "sewer," and a farm drain is a "drain," it seems to us that the conduit built under city streets for carrying storm water corresponds much more closely to the former than to the latter, and that the term "storm sewer" is more appropriate than "storm drain." In some cases "separate sewers," "combined sewers" and "storm drains" are all found combined in one system of—what? Sewers or drains?

After a heavy storm a combined sewer may carry fifty times as much storm water as domestic and industrial sewage. Is it still sewage? After a light storm a "drain" may carry enough street washings to make the water much more foul than the highly diluted sewage just referred to. Should it not be classed as sewage? A sewer always carries sewage, but a storm drain is not defined as carrying drainage, although a land drain is.

Until a comparatively few years ago no city built conduits exclusively for house wastes; and the first sewers were built with a view to receiving storm water only, the discharging of house wastes therein being incidental and more or less surreptitious. It is only within the life of the writer that the sewers of Paris were permitted to receive house wastes.

In size, in degree of pollution of the liquid carried, and especially in its association with city streets and city wastes, the conduit under discussion seems to us to correspond more closely with the combined sewer than with the land drain. If we call it a storm "sewer," all of the above inconsistencies and questions vanish.

To paraphrase Mark Twain's report of Adam's (or was it Eve's?) reason for giving its name to the frog: "It looks like a sewer, it acts like a sewer. Why not call it a sewer?"

PREPARE FOR NEXT WINTER'S SNOWS.

Four or five months from now it will be difficult to realize the conditions that, on many of the northern roads during last January and February, interfered seriously with all motor travel on such roads. For this reason, and because opportunities may vanish in the mean time, thought should be taken now by each highway official of what he expects to do next winter in order to keep his roads clear of snow. It may even, in some cases, be necessary to begin at once taking some action in the matter; such as including an estimate of the cost in the budget, or securing legislation that will permit using automobile fees or other maintenance funds for this purpose.

The Highways Transport Committee of the U. S. Council of National Defense has said: "Snows of the present winter have shown the imperative need of a nation-wide effort to keep highways open every day of the year. Storms of unprecedented severity have frequently killed travel over urgently-needed roads and thereby isolated a great percentage of farms. This interruption of travel struck serious blows at the nation's war preparations. It added to the food shortage. It deranged business. It was the direct cause of hardship and material financial loss. Short-haul freight that could not be handled by already overtaxed railroads, but which could have been diverted to clear highways, was piled up to aggravate the already immense congestion. Such a condition would be economic folly at any time; with the nation at war it becomes a national peril. 'Speeding

up' is vital to every war activity, and to keep all roads open for the increasing traffic they must bear is now virtually a patriotic obligation."

Everywhere, but especially in the east, we find unprecedented activity in all lines connected with increasing motor truck traffic. Highway departments are arranging to extend their road systems, connect up missing links, and improve the existing roads. Automobile manufacturers are working to capacity in turning out trucks; and organized effort, following the lead of Connecticut, is endeavoring to intensify the service of existing trucks by providing return-load opportunities and keeping all working as nearly as possible at 100 per cent efficiency.

All this effort may be nullified for weeks or even months each winter if snow is allowed to block the roads. This was bad enough last winter. But by next winter a regular highway traffic will have been developed several times as great as the present, and a sudden and complete interruption of this would be as serious as was the railway congestion of a few weeks ago. To make provision for keeping the main roads open next winter is as important as the laying out of a road-building program for next summer. With twice as many soldiers in France to provide for and twice as many ships leaving Atlantic ports, it will next winter be doubly vital to maintain uninterrupted service in this land traffic end of Pershing's lines of communication.

BITUMINOUS PAVEMENT FOUNDATIONS.

Editor, Municipal Journal.

Dear Sir—It is refreshing to note by article in your issue of February 2, page 90, endorsed and supplemented by experience of another writer on page 128 of your issue of February 16, 1918, that two prominent municipal engineers, located more than 1,500 miles apart, have observed and reached the same conclusion, to wit:

1. In every case where the surface is cracked there is "a crack in the (Portland Cement) concrete base, either directly under that in the surface material or only a very slight distance therefrom."

2. "In at least 98 per cent of these cases a crack in asphaltic wearing surface means a crack in concrete base or in close proximity."

3. In no case have any of our asphaltic pavements laid on macadam base developed cracks, including pavements 7 years old.

4. Where the surface mixture has been properly compounded and laid "The cause of cracks in the asphalt surface is undoubtedly in the (Portland Cement Concrete) base, except in those very rare instances where some local case of improper drainage or defective support may cause cracking."

5. "Just so long as asphaltic wearing surfaces are laid on (Portland cement) concrete base, they will crack and there is apparently no effective way of overcoming this tendency or of permanently repairing such cracks."

I say the clear statements of **facts** quoted above are "refreshing" because of the fact that a large percentage of engineers lean to the opinion that Portland cement concrete is the "ne plus ultra" (some would say **"only"**) foundation for paving surfaces.

In a paper before Section D of the American Society for the Advancement of Science, December 28, 1916, on the subject: "Stone and Concrete Foundations from the Standpoint of Efficiency and Economy," the present writer said:

"Bituminous cement concrete, i. e., concrete in which the well proportioned coarse and fine aggregate, which may be either natural gravel and sand or crushed stone and sand heated and mechanically mixed with suitable bituminous cement and spread and rolled on the previously compacted sub-grade, has the extremely important advantage of absolutely overcoming the cracking of Portland cement concrete foundations. It also has the, at least equally, if not more important, advantage of a thoroughly united and unified foundation and surface, the two courses being of the same class of materials. The advantages are:

"(a) Retarding the tendency of the wearing surface slipping or shifting under traffic, either on the base or through the integral parts of the surface rolling on themselves.

"(b) Such a unified foundation and surface also permits the use of a somewhat thinner pavement, both as to surface and foundation, than is equally safe when the foundation and surface are of as widely different and non-unified materials as bituminous surface and either crushed stone or Portland cement concrete foundation.

"In first cost of surface and foundation the difference depends chiefly on the local relative costs of Portland cement and suitable bituminous cements. Under the prices to which Portland cement has advanced during the past two years, there are many sections where pavements using bituminous concrete are lower in cost than Portland cement concrete and in but few places at this time is there any considerable advantage in cost of adequate surface and foundation in favor of Portland cement concrete."

On special request the writer can supply a few copies of that paper, to parties who are interested in the subject.

The fact is that **the very oldest and most successful asphaltic pavements** laid in the United States, particularly in Washington, D. C., Erie, Pa., Buffalo, N. Y., Cleveland, Ohio, and Columbus, Ohio (all laid before Portland cement was commercially available and when "Natural" hydraulic cement was little used) and therefore, before there was any occasion for any Portland cement interest propaganda, were laid on bituminous concrete foundation.

It is high time that engineers and the public generally recognize these facts.

In Warren Brothers Company's experience **it has yet to receive its first report of any cracks in any Bitulithic pavement or Warrenite road, laid during the past seventeen years throughout the United States and Canada, on any type of base except Portland cement concrete.** This business aggregates:

Pavements laid on various types of bituminous base, 25,239,842 sq. yards.

Pavements laid on old macadam road base, 4,153,701 sq. yards.

Pavements laid on Portland cement concrete base, 13,680,091 sq. yards.

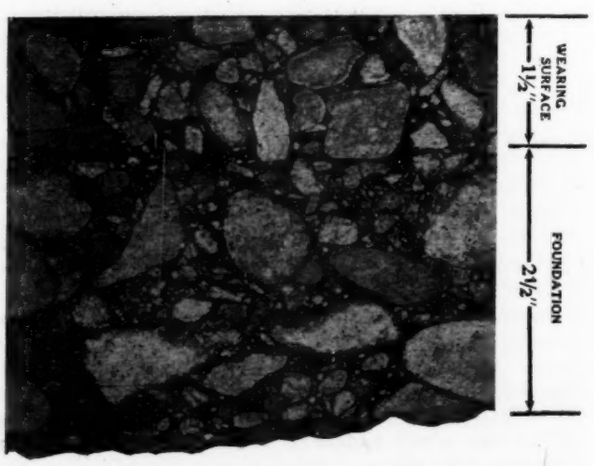
Doubtless the most improved form of "bituminous base" is that known as "bituminous cement concrete" and in some sections as "black" base. It is made of dense mixture, of either crushed stone or gravel and with the completed bitulithic wearing surface has a depth (depending on climatic, soil and traffic conditions) of from four to five inches. This construction is illustrated by the accompanying sawed vertical cross section, being of construction in the U. S. A. Cantonment, Camp Lewis, American Lake, near Tacoma, Wash.

This type of base has been laid in connection with bitulithic pavements and Warrenite roads at forty-one points in the western states and British Columbia, totaling 1,897,174 square yards during the past six years.

The advantages of this dense bituminous cement concrete base are:

(a) Absolutely overcomes cracking.

(b) The surface and base, being of the same character of material rolled together, become thoroughly unified with no line of cleavage. Consequently, not only the entire depth of wearing surface, but the foundation itself is "available for wear" by abrasion of traffic before the sur-



SAWED SECTION OF PAVEMENT WITH BITUMINOUS BASE.
Laid at Camp Lewis, near Tacoma, Wash.

WARRENITE ON ASPHALTIC CONCRETE BASE IN ARIZONA.
This road continuously carries loads like this—a 5-ton truck and 12 tons of cotton on trailer.

face is worn so thin as to not sustain the weight of traffic. It is well known that when an asphaltic surface on Portland cement concrete base wears to a remaining depth of say one inch, it then quickly breaks up under traffic. Not so with dense bituminous concrete base, because the surface and base are "knit" together—no line of cleavage.

(c) Far greater resiliency and therefore minimum of wear by "shock" of traffic as compared with rigid Portland cement concrete base. The difference is relatively comparable to that of hammer blows on pieces of stone resting on a block of hard wood and on an anvil.

(d) A well laid dense bituminous cement concrete base, on a well compacted sub-soil, overlaid with a stable wearing surface, is ample to sustain traffic and, for reasons stated above, the wear and tear is less than in the case of Portland cement concrete base.

The two constructions are about the same in cost, depending on local conditions and costs of materials. Sometimes one and sometimes the other is the lower in cost, but in no case, in the writer's judgment, is the difference either way such as to warrant adoption of Portland cement concrete base because of lower cost. In a very few cases where the subsoil is abnormally weak, the use of Portland cement concrete base is justified whatever the relative cost may be, but experience has proven that this condition prevails only occasionally.

I will gladly send further information and specifications for bituminous concrete base to any who may desire the information.

Very truly yours,
GEORGE C. WARREN,
President, Warren Brothers Company.

RETURN LOADS IN CONNECTICUT

State-wide Organization for Stimulating Motor Truck Freight Hauling for Short Hauls and as Feeders for Water, Trolley and Railway Lines.

The transportation problem has been a serious one in Connecticut, where a considerable percentage of the cities are engaged in the manufacture of war materials, and this was one of the first sections of the country to use motor trucks systematically to aid in solving the problem. The so-called "return load" plan was started in October, 1917, by the Transportation Committee of the Council of Defense. The chairman, Wm. S. Conning, described the operation of this plan before the latest meeting of the Highway Traffic Association of the State of New York.

On first taking up the problem, the committee increased by 100 per cent the tonnage hauled by the trolley companies, and developed the service rendered by the Connecticut river and Long Island sound steamers. Trucks, however, were needed both as feeders of these and for short-distance hauling within the state. The committee, through the State Automobile Department, requested all owners of motor trucks in the state to report what time and capacity of truck they could furnish for carrying return loads. About 700 expressed their desire to increase the amount of freight they were carrying.

Transportation bureaus were then established in every large city and entered in the telephone books under the heading "Return load." At each bureau is registered the number, name and address of every idle truck, whether idle the whole or a part of the time. Also every truck was registered that had an established route between two cities, and the days when deliveries were made in the case of privately owned trucks such as grocers, manufacturers, and public trucks; and all were urged to make no trips empty but to carry loads both ways. As soon as a bureau was established, each truckman in the territory was asked to register there. The bureau also obtained a list of the shippers in each territory and sent a letter to each one explaining the plan and asking him to call upon the bureau when he had freight to be carried. What seemed to be the best way to gain cooperation was meeting with boards of trade, traffic men's associations and similar organizations and explaining to them the plan in great detail.

No difficulty was found in securing idle trucks. In each city of about 100,000 it is safe to say that there are 100 trucks idle either all or part of the time, of one to five-ton capacity, and many more owned by private firms that are willing and anxious to carry return loads and thus make their trucks 100 per cent efficient.

There are now fourteen bureaus established, and a map has been prepared showing the various truck routes and the locations of the bureaus, a copy of which map is furnished to each bureau, together with a card index showing the location of the truckmen represented by each route number shown on the map. In small towns where there are only a few trucks, the State Council has asked a town committee to post the truck information in a central place where any shipper can readily obtain the information. An effort is being made, however, to keep in touch with the small towns through the large bureaus. The bureaus were all started in Chambers of Commerce or similar organizations, but several have since been made a part of the War Bureaus organized by the State Council of Defense, which plans to consolidate all war work under one head.

The question of rates has come up many times, but the committee has always taken the attitude that the sole function of the Traffic Bureaus is to get the truckmen and shippers together, and that they must settle the rates between themselves; it being fairly well established that, as return loads cut the cost to the carrier, he therefore cuts the cost to the shipper where he can get his return load assured.

In many instances return loads have been obtained for Connecticut trucks going into New York and Massachusetts by means of information filed with the secretary at Hartford, but it would greatly facilitate the movement to and from other states if they would establish bureaus where Connecticut truckmen could call for loads or arrange for them before leaving Connecticut with a load for the state in question. Mr. Conning believes that the work of the committee has been well worth-while and has accomplished a great economic good in Connecticut, and that the plan will be continued after the war is over because of the appreciation of this.

On March 7th the New Jersey State Council of Defense asked all mayors of cities of 10,000 population or more to establish return load bureaus for carrying out in that state the plan outlined above. It is expected that thirty-five municipalities in that state will establish such bureaus.

The WEEK'S NEWS

Progress of Federal Aid Highway Work—State Control of California Highways—Twenty-Year Rate Fight Lost by Denver—Provincial Competition Puts Private Company Out of Business—Higher Electric Rates for Illinois Cities—Power Projects of Los Angeles—Fires in Canton and New York—New City Managers in Beaufort, S. C., and Madill, Okla.—New York Has Power to Seize Coal—Plans for $50,000,000 Federal Housing.

ROADS AND PAVEMENTS

Black Milestones for Neglected Federal Aid Roads.

Washington, D. C.—According to a recent statement by Logan Waller Page, director, U. S. Office of Public Roads, regarding maintenance of Federal aid highways, "should the state fail properly to maintain a federally aided road, Uncle Sam, it is planned, will put the milestones in mourning. They will be painted black. So these F. A. R. markers will stimulate the interest of the community in its roads." The same statement says that the country has 2,450,000 miles of public roads and about 11 per cent of them are improved with some kind of surfacing. The modern hard surfaced roads, including macadam or better, constitute not over 5 per cent of the total. "Out of 228 projects submitted by the state highway departments to November 30, 1917, inclusive, 168 have been approved and only six disapproved. The amounts of Federal aid involved in the projects submitted is $5,664,442.31; the total, including state and local funds, $13,583,577.98; the total approved is $4,052,142.85 in Federal funds and $9,770,179.40 in Federal, state and local funds. Those states which had highway departments at the time the apportionment was made for the fiscal year ended June 30, 1917, must enter into the project agreements on or before June 30, 1918, or the amount allotted to them and not covered by project agreement will be reapportioned under the terms of the act to all of the states. Of the 168 projects approved eighty-eight sets of plans and specifications have been submitted. Of this latter number seventy-two have been passed by our engineers and recommended for approval, so that only sixteen sets of plans and specifications submitted are now pending. All Federal aid roads will be specially marked. Marking posts will be concrete, about four feet high, modeled after the Washington monument. On the side next the road will be two shields; one the shield of the United States with an eagle and the initials F. A. R. (federally aided road) and the other the state shield. Means are being studied whereby these posts may be made into milestones, wherever this is practicable, because where only a section of a road is built by Federal aid and the rest of that road is built by the state without Federal aid, it will not be possible to identify it with the F. A. R. milestones, but simply by markers showing the boundaries of the section constructed with Government aid. These markers will indicate the distances in both directions of the nearest large city in the state and the nearest large city in the adjoining state."

State Commission Controls Use of Highways.

Sacramento, Cal.—The fact that persons owning land adjacent to a state highway have been cuting down trees within the road limits and have tried to justify their acts by claiming to have received permission from their local board of supervisors, has caused the state highway commission to order a strict enforcement of the law regarding such actions. The control of all public highways, which have been taken over and adopted as portions of the state highway system, is vested in the state highway commission. To remove any doubt as to jurisdiction and to prevent further destruction of trees, and also to encourage the planting and preservation of such, the highway commission has issued special instructions to all county boards of supervisors and district attorneys. The law on this point provides:

"No state road or highway shall be dug up for laying or placing pipes, conduits, sewers, wires, railways or other objects, and no tree or shrub in or on any state road or highway shall be planted, trimmed or removed, and no obstruction placed thereon, without a written permit, and then only in accordance with the regulations of such Department of Engineering or its duly authorized officers or employes; and the work shall be done under the supervision and to the satisfaction of the Department of Engineering or its appropriate officers or employes, and the entire expense of replacing the highway in as good condition as before shall be paid by the persons to whom the permit is given or by whom the work is done; but a city or town may, within its corporate limits, dig up a state road or highway without such approval or permit in case of immediate necessity; but in such cases it shall be forthwith replaced in as good condition as before at the expense of the city or town.

"Any person convicted of making any opening in a state road or highway or placing any structure thereon, or changing or renewing any structure thereon without obtaining a permit as herein provided, or not in compliance with the terms of such a permit, or otherwise violating the provisions of this act, shall be guilty of a misdemeanor."

Big Road Bond Issue Invalid—No Election Booths.

St. Joseph, Mo.—The $2,000,000 bond issue voted at the recent election by Buchanan County, Mo., has been declared invalid. The decision is based on the facts that election booths were not used and that the voters had not been notified of the new location. The majority at the election was 5 to 1 for the issue. It is understood that a new election will be held.

WATER SUPPLY

Denver Loses Twenty-Year Water Rate Fight.

Denver, Colo.—The city of Denver in the Supreme court at Washington, has lost its fight of twenty years' duration against the Denver Union Water Company over consumers' rates. Injunctions restraining the city from enforcing an ordinance reducing water rates 20 per cent, alleged to be confiscatory on the ground that it would take the company's property for public use without compensation, were sustained. Justices Holmes, Brandeis and Clarke dissented, being of the opinion the proceedings should be dismissed. Lower court valuations of the company's property at $13,415,899 were upheld. Since the proceedings were instituted the city obtained an option to purchase the property on the basis of that valuation. The water company contended the ordinance's provisions were so unreasonable and burdensome as to make it invalid, would reduce the company's returns to 2.88 per cent, that the ordinance was passed without any investigation and that its true object was to force the company to sell its property to the city at less than real value. Denver officials denied any intention to confiscate property, asserted the ordinance would yield larger returns than claimed and contended the company did not operate its plant economically. In holding that the 20 per cent horizontal reduction in water rates of the Denver Union Water Company, as authorized by the city council in 1914, is unreasonable the court also fixed a price of the plant valuation that is to be the subject for a special election within a year, according to an agreement pending between the city and the company. Following the appeal of the water company rate case to the Court of Appeals and later to the highest tribunal, the company gave the city an option to purchase the system based on the valuation given by Special Master W. J. Chinn. The Chinn price was $13,415,899. The Supreme Court now upholds the appraisement of the Denver Federal court as submitted by Master Chinn. The company is bound by the agreement entered into some months since to abide by the ruling of

the United States Supreme court. This last decision relieves the company from paying back to customers approximately $1,000,000 for the reason that pending the ultimate determination of the case the proposed reduced rates were held in abeyance by court order. Special Master Chinn, who was appointed by federal judge Robert E. Lewis to determine whether the rates under the proposed reduction would bring a fair and adequate return, found that only 3.64 per cent would be realized, which he held to be insufficient. The Chinn valuation included $2,947,617 in water charges for payments, railway tracks, telephone conduits and other civic improvements that necessitated the tearing up of streets.

Discontinue Free Water List.

Sandusky, O.—Complying with instructions of state examiners, based upon an opinion of attorney general McGee, city manager Lehrer has ordered that free service of city water to hospitals, parochial schools, Carnegie library, the county Children's Home, cemeteries, etc., be discontinued. The order dates from January 1, this year. All of the institutions affected have been receiving free water, although it was metered, and it is roughly estimated that the amount consumed might represent a revenue of a thousand dollars. The county has been paying for the water for the court house, jail and infirmary. Since the city appropriates money for the hospitals and library and owns and maintains Oakland cemetery, the charging for water in these cases will have no material effect. Officials say, however, that it is necessary under the order, which was issued to all water works examiners and which quotes the ruling by the attorney general as follows: "Where departments, institutions or individuals receive water from a municipal water works without charge and without authority of law, such departments, institutions, or individuals may be held liable for such water received and the officer responsible for the management of such water works may be held civilly liable for water so furnished, and a reasonable estimate of the water so furnished, based upon the circumstances of each particular case, may be the basis for recovery." The instructions further read: "We feel that our examiners have all been thoroughly advised as to the differences between legal free water and illegal free water and you are hereby ordered from and after this date in all examinations to make findings for recovery jointly against the department, institution or individual receiving such illegal free water, together with the director of public service who illegally furnished such free water, based upon your best estimates. It is the further opinion of the writer that a director of public service allowing free water illegally is also subject to the provisions of sections 4263 and 4268 relative to nonfeasance in office and gross neglect of duty, as he is responsible for the conduct of the water works in conformity with law."

STREET LIGHTING AND POWER

Company Cannot Meet Government Competition.

London, Ont.—Failing to compete with the rates of the Provincial Hydro-Electric Power Commission, the London Electric Company, Ltd., a corporation controlled by Mackenzie & Mann, has decided to suspend operation. The London Electric Company has announced to its customers, who use about 2,500 h.p., that it will end its business at once. Its plant will be dismantled and scrapped. The London Electric Company formerly sold power for 9 cents per kilowatt-hour net, plus meter rent. When the Hydro-Electric Commission entered the field it charged 4.5 cents per kilowatt-hour. It gradually reduced charges to 1.5 cents per kilowatt-hour, and the London Electric Company was unable to stand the cutting. When the private company was unable to secure coal for its plant during the recent shortage, directors decided to suspend operation. It is reported that the Ontario government has ordered Mackenzie & Mann to turn over two of its generating machines at Niagara Falls, Ont., to the Hydro-Electric Commission.

Gas and Electricity Consumption in New York.

New York, N. Y.—The state public service commission for the First District in its report to the legislature says: "The most recent statistics for gas and electric companies are for the calendar year 1916. In that year gas companies in New York City manufactured and sold 44,565,753,000 cu. ft., an increase of 4.76 per cent. Sales of electricity, however, showed a very much higher percentage of increase, the enlarged use being accounted for in great part by the material reductions in Manhattan, the Bronx and Brooklyn. Increase in population was also partly responsible. Electric companies sold to the public 846,201,369 kw.-hr. and received therefor $38,687,806, an increase of 16.40 per cent. Consumers numbered 360,669, against 306,217 in 1915. Gas sales were about $6.61 per capita and electric about $7.03 per capita."

Many Towns Affected by Higher Rates.

Springfield, Ill.—Orders have been entered by the public utilities commission in a number of cases. One order suspends to June 28, 1918, proposed rates for electric power, filed by the public service of northern Illinois, affecting 144 towns, among them Kankakee and Joliet; and authorized the company to issue $2,000,000 of gold notes and $2,667,000 of gold bonds. The Central Illinois Utilities company is authorized to put into effect a rate of 16 cents a kilowatt-hour for residence lighting covering the first thirty hours and nine cents for all electricity used in excess of thirty hours, and other rates for heating, etc. Twenty-seven towns are affected by this order. The Central Illinois Lighting company is permitted to withdraw its flat rate steam heating rate at Peoria and substitute a meter rate after October 1, 1918. Certain commission rules requiring free electric and gas extensions to consumers are suspended, as requested of the public utilities commission by the Quincy Gas, Electric & Heating Company. The high cost of materials was given as the reason for the request.

Los Angeles May Develop More Power.

Los Angeles, Cal.—A recent conference held here between representatives of the state, the public service commission and the state fuel administrator discussed the diversion of city funds for duplication of the present distributing system to the development of aqueduct water power. This followed the Federal fuel administrator's recommendation to develop hydroelectric power in order to conserve oil fuel. E. F. Scattergood, electrical engineer, Aqueduct Power Bureau, reported that of the $5,000,000 voted for a distributing system nearly half was available. Aqueduct power could be developed to supply all consumers now served by the Los Angeles Gas & Electric Company steam plants. This could be effected within a year, he believed, by completion of power plant No. 2 in San Francisquito Canyon and utilizing to the full the capacity at No. 1. This would mean a total of 33,000 h.p. added to the present capacity. The total cost of consolidating the three Los Angeles systems and increasing city generating capacity to a point where it could meet all needs would be about $1,400,000 at present machinery quotations, but 35 per cent of this could be saved and prompt delivery of machinery assured if government intervention could be secured. Of this total about $40,000 represented cost of connection with the Los Angeles Gas & Electric Corporation, which could be effected in about a month. The report says: "In addition to supplying the 9,000 consumers and the street-lighting load connected to municipal lines as well as power requirements under the operating agreement with the Southern California Edison Company, the city plants have a large surplus capacity. From this surplus the city is now supplying all power used by the Pasadena municipal plant, thus eliminating consumption of approximately 5,000 bbl. of fuel oil per month at the Pasadena steam plant. In addition to supplying Pasadena, the city plants have surplus sufficient for practically all of the electric power generated by the Los Angeles Gas & Electric Corporation steam plants for use of electric consumers of that company within the city." It is estimated that the substitution of aqueduct

power for that generated by the private company in steam plants would save 45,000 barrels of oil per month. The private company has offered to purchase the available power from the city or to co-operate in oil conservation in such other manner as the fuel administrator may recommend.

FIRE AND POLICE

Difficult Fire Destroys Block.

Canton, O.—The worst fire in the city's history totally destroyed with all contents the Swearingen building, the city's largest business block and the buildings adjoining it on the south, gutted the building west of the Swearingen building, and seriously damaged adjacent stores by smoke and water. The total loss is estimated at over $150,000, with partial insurance. All the contents of the several offices in the Swearingen block are total loss, with small insurance. One man was seriously injured by a fall from a ladder. John Beadles, fireman, suffered severe bruises from fragments of falling wall; three men were overcome and were dragged out in a semi-conscious condition. Chief of police Kitchell missed death by a hair's-breadth under a falling ladder and several firemen and volunteer assistants had narrow escapes from flying debris, falls and other menacing incidents during the long fight against the difficult fire.

Chief and Firemen Injured in Blaze.

New York, N. Y.—Fire in a six-story tenement resulted in severe injuries to ten persons, among them five firemen, including battalion chief John McLoughlin, who is now in hospital in a serious condition. Chief McLoughlin and the other firemen received their injuries when a burning staircase from which they were directing a hose into the flames on the third floor collapsed under them, and buried them one story below under a mass of blazing debris. Three children, a man, and a woman were also badly hurt before the flames were extinguished. The fire started on the second floor, when an oil stove was accidentally overturned by the sudden opening of a door. The blaze spread quickly from room to room, and the whole second floor was aflame when the firemen arrived. There were some forty children and adults in the building. When battalion chief McLoughlin arrived he decided to fight the fire from the fourth floor, and leaped up the stairs, followed by his company. The firemen hurried through all the rooms, picking up children here and there and passing them to the nearest fire escape, where they were led down to safety by other firemen. Rescue work was hampered because many of the fire escapes were clogged with clothes and utensils. While directing his men on the staircase leading from the third to the fourth floor, chief McLoughlin suddenly felt the stairs tremble under him. Before he could call his men out of danger the stairs collapsed, and he and his men fell to the third floor.

GOVERNMENT AND FINANCE

Vote in Favor of Commission Form.

Cape Girardeau, Mo.—The voters at the special election declared in favor of the commission form of government by 191 majority in a light vote cast. The total vote was 1,093, there being 642 for and 451 against the proposition. Following the election a mayor and two councilmen were elected at the regular city election after the candidates for the three positions were chosen at a primary just prior to the date of the regular municipal election.

Beaufort's New City Manager.

Beaufort, S. C.—The new city manager, who succeeds H. G. Otis, now manager of Auburn, Me., is John R. Kneebone, formerly on the staff of the city engineer of Flint, Mich. He had been in Flint since July 1, 1916, serving first for six months as civic secretary for the St. Paul Men's Club and later as cost accountant in the city engineering department. Mr. Kneebone received his A. B. at the University of Michigan in 1915. The university has given him the new degree of "master of arts in municipal administration." He is one of three men to enter this course, the first to be given in the United States, and is the first to complete it, the other two men having left the university to take positions as city managers. He is said to be the youngest city manager in the country.

New City Manager Appointed.

Madill, Okla.—H. C. McDuffie, who was recently appointed city manager under the new commission-manager charter is to receive a salary of $1,800 a year. The population of Madill is less than 4,000.

MISCELLANEOUS

City Given Power to Seize Coal.

New York, N. Y.—Mayor Hylan recently signed the ordinance passed by the board of aldermen, authorizing the city to seize coal for the general welfare, in the interests of health and for the relief of the poor of the city. As the mayor believes that some of the public service corporations have more coal stored than is necessary the fuel administration is watching with considerable interest to see what the mayor will do. Under the ordinance the mayor can acquire in the name of the city any coal within the limits of the city. The ordinance provides that thirty days after taking the coal the corporation counsel shall apply to a justice of the supreme court for a determination of the amount of compensation the owner shall receive. No advantage has yet been taken of the ordinance.

The $50,000,000 Federal Housing Project.

Washington, D. C.—President Wilson has signed the act of Congress appropriating $50,000,000 for housing shipyard workers. The fund will be administered by the United States Shipping Board. In preparation for this legislation the Emergency Fleet Corporation has for a long time been organizing its housing forces under the direction of J. Rogers Flannery, president of the American Vanadium Co., of Pittsburgh. Mr. Flannery will head the housing division of the corporation and will be assisted by Meyer Bloomfield, until now head of the industrial service division of the Fleet Corporation. Plans and construction have already progressed far in one shipyard, that at Bristol, and a special allotment of $8,000,000 for similar purposes has just been made for one of the other Government yards at Hog Island, Philadelphia. No housing will be provided at the Submarine Boat Corporation's plant at Newark, N. J., the third Government agency plant. Mr. Flannery has announced that the new funds will be expended not only in the outright purchase and construction of houses at the Government yards, but in improving transportation facilities and in loaning money for housing to the private yards engaged on Government contracts. Representative Frank Clark, of Florida, chairman of the Committee on Public Buildings and Grounds, introduced a bill in the House of Representatives appropriating $50,000,000, to be expended under the direction of the Secretary of Labor "for the purposes of providing housing, local transportation and other community facilities for such industrial workers as are engaged in industries connected with and essential to the national defense, and their families, only during the continuation of the existing war." This bill takes the place of the one taken from the Committee on Labor by Mr. Clark's committee and is the only housing bill now before Congress. The bill gives the broadest powers to the Secretary of Labor except that it forbids him to make a "percentage or cost-plus contract for any work under this act." The Secretary of Labor has made Otto M. Eidlitz director of housing of the department, and he will administer the funds provided by the new bill if it is enacted.

NEWS OF THE SOCIETIES

CALENDAR OF MEETINGS.

March 17-24.—PAN-AMERICAN CONGRESS ON CHILD WELFARE, Montevideo, Uruguay. Secretary, Edward N. Clopper, 105 East 22d street, New York, N. Y.

March 27-28.—INDIANA SANITARY AND WATER SUPPLY ASSOCIATION. Annual convention Claypool Hotel, Indianapolis. Secretary, W. G. Ulrich, Indianapolis Water Company.

April 15, 16.—SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION. Annual convention, Galveston, Tex. Secretary, H. S. Cooper, Dallas, Tex.

April 15-17.—UNITED STATES GOOD ROADS ASSOCIATION. Annual convention, Little Rock, Ark. Secretary, J. A. Rountree, 1021 Brown-Marx Bldg., Birmingham, Ala.

April 18-19.—BANKHEAD NATIONAL HIGHWAY ASSOCIATION. Annual meeting, Little Rock, Ark. Secretary, J. A. Rountree, 1021 Brown-Marx Bldg., Birmingham, Ala.

April 18-20.—SOUTHWESTERN SOCIETY OF ENGINEERS. Annual convention, Douglas, Bisbee and Tucson, Ariz. Secretary, C. E. Barglebaugh, El Paso, Tex.

April 23-26.—SOUTHWESTERN WATER WORKS ASSOCIATION. Seventh annual convention, Tulsa, Okla. Secretary-treasurer, E. L. Fulkerson, Waco, Tex.

May 13-17.—AMERICAN WATER WORKS ASSOCIATION. Annual convention, St. Louis, Mo. Secretary, J. M. Diven, 47 State street, Troy, N. Y.

May 21-23.—ARKANSAS ASSOCIATION OF PUBLIC UTILITY OPERATORS. Annual convention, Hot Springs, Ark.

Ontario Good Roads Association.

At the recent annual convention of the Ontario Good Roads Association held in Toronto technical papers and addresses were appreciated by a good-sized body of members. Hon. Findlay Macdiarmid, minister of public works, Ontario, announced that all the counties in the province with two exceptions were co-operating in the good roads movement. The question of placing a tax of 2c. per foot on property facing county roads was discussed, but a resolution to that effect was defeated. The following officers were elected: Honorary presidents, J. A. Saunders and S. L. Squires; president, C. R. Wheelock; secretary-treasurer, Geo. S. Henry.

Illinois Highway Improvement Association.

The $60,000,000 good roads bond issue for the state was the principal topic of discussion at the well-attended convention of road boosters of the Illinois Highway Improvement Association held Feb. 26 and 27 in Peoria.

Most of the conference centered on whether it will be possible to utilize local materials and labor, with a minimum burden upon the transportation systems, in improving the state aid roads between Springfield and Chicago. Opposition to road work during the war as being a drain upon labor resources and transportation facilities, it is hoped, will be overcome by planning for the use of Illinois river gravel and the use of labor that would not be used in farm work or in the production of war necessities.

Gov. Lowden and other state officials were in attendance at the meetings. A banquet with a special program of addresses and music concluded the first day's sessions.

Civil Engineers' Society of St. Paul.

About 150 members attended the annual banquet of the Civil Engineers' Society of St. Paul and reception to the new officers. These are: President, A. F. Meyer; vice-president, E. S. Spencer; secretary, P. C. Ganger; treasurer, E. O. Korsmo.

New Jersey Sewage Works Association.

The New Jersey Sewage Works Association recently elected the following officers for the ensuing year: President, Paul Molitor, Madison; secretary, Fred T. Parker, Atlantic City. At the recent meeting of the association, George F. Fuller, consulting engineer, New York, read a paper on the operation of sewage work plants.

Connecticut Society of Civil Engineers.

At its 34th annual meeting held recently at Hartford, the Connecticut Society of Civil Engineers gave over one and a half days to technical meetings. A banquet ended the first day. In spite of the war conditions and many of the members being away on war service, meetings and banquet were well attended. William R. Dunham, Jr., chief engineer of the Connecticut Co., New Haven, was elected president for the ensuing year. J. Frederick Jackson, of New Haven, is secretary of the society.

Iowa Association of County Engineers.

The Iowa Association of County Engineers held a meeting Feb. 27 and 28 at Ames under the auspices of the state highway commission, at which road and bridge work prospects for next year were taken up.

Brooklyn Engineers' Club.

At the Feb. 14 meeting of the Brooklyn Engineers' Club, Andrew F. Johnson spoke on "Some Notes on the Development of Electric and Gas Facilities in Central and Eastern Long Island."

Highway Engineers' Association of Missouri.

The eleventh annual meeting, a three-day convention, of the Highway Engineers' Association of Missouri was recently held in Kansas City. More than a hundred members from all over the state attended the opening session. Alexander W. Graham, state highway engineer, delivered an address on "What the State Highway Engineer Expects of County Highway Engineers in 1918." Papers were read by B. H. Bain and T. C. Stanley on various engineering phases of road building. C. E. Smith, consulting engineer, St. Louis; J. C. Travilla, consulting engineer for the Dunn Wire Cut Lug Brick Co.; Harvey S. Owen, engineer with the Portland Cement Manufacturers' Association, and S. M. Williams, president of the Highway Industries Association, read papers. After the third session, Prof. E. J. McCaustland, of the University of Missouri, urged co-operation of the university with the highway officials of the state. Walter Buehler, of the Barrett Manufacturing Co., discussed the bituminous treatment of hard-surfaced roads.

PERSONALS

Black, Ernest, of the consulting engineering firm of Black & Veatch, Kansas City, Mo., has been commissioned captain in the finance division of the aviation section of the Signal Corps, U. S. A., and put in charge of appraisal of property at plants manufacturing airplanes.

Dixon, Dr. Samuel G., state commissioner of health of Pennsylvania, died recently in Philadelphia at the age of 66. Dr. Dixon was appointed commissioner in 1905, at the time the department was created, and was reappointed by succeeding governors. He was graduated from the medical department of the University of Pennsylvania in 1866, and studied in Europe. In 1899 Dr. Dixon became professor of sanitary engineering at the University of Pennsylvania, and in 1890 professor of bacteriology and microscopical technology at the Academy of Natural Sciences in Philadelphia. He was an acknowledged authority on the subject of tuberculosis.

Martin, H. P., for the past four years supervisor of streets of Dayton, O., has been appointed to the position of director of public service, made vacant by the promotion of former director Barlow to the position of manager. H. P. Ullmer, supervising inspector of the street department, has been promoted to the position of supervisor of streets.

McBride, G. G., who has been assistant state engineer of Nevada, is now captain in the ordnance department of the army, on duty at Washington.

Rands, H. A., civil engineer, Portland, Ore., has been placed by the Port of Portland Commission in charge of the traffic survey of the Upper Columbia and Snake Rivers. Mr. Rands will submit his suggestions and reports on the work to the port of Portland's traffic survey committee.

Stevens, Colonel Edwin A., formerly state highway commissioner of New Jersey, died March 8 at Washington, D. C., where he was serving as a shipyard inspector under appointment by President Wilson. Colonel Stevens had held many offices in New Jersey. He was born in Philadelphia on March 14, 1858, and attended Princeton Uni-

(Continued on page 236.)

NEW APPLIANCES

Describing New Machinery, Apparatus, Materials and Methods and Recent Interesting Installations.

A G A DANGER SIGNALS.

Acetylene Flashing Devices with Useful Features.

The A G A danger signal, made in a number of forms, including a highway signal and a railway grade crossing signal, is designed as a reliable luminous signal needed in safeguarding dangerous curves, grades or crossings. The A G A signal is calculated to fill the three necessary requirements of such safety service: Character of light is such that it cannot be mistaken for anything but a danger signal; simple construction and automatic operation without attention for long periods; reasonable first cost and lost maintenance charges.

The A G A highway danger signal consists essentially of a post carrying a transparent sign equipped with a red lens through which the light flashes a red warning signal and at the same time illuminates the lettering on the sign with sharp, distinctive flashes. The A G A flash light has proved its reliability under all conditions in hot and cold weather and in dry and damp climates. It is used by the United States Government and European countries for lighthouse service. The flasher designed especially for railroad and highway signal work is on the same principle as the large A G A flashers used for lighthouses and buoys. The A G A flasher produces distinct and characteristic light and dark periods by automatically shutting off and opening the gas outlet to the burner. These short, sharp, powerful flashes provide a signal extremely characteristic, penetrating and conspicuous. The flasher is set for the light characteristic most suitable for this work—1/15 second light and 14/15 second dark, or 60 flashes per minute. The number of flashes per minute, however, can be increased or decreased as desired. Operation is automatic. On account of its construction, simplicity and few moving parts, the light is reliable and durable.

The flashing device operates as follows: The gas is admitted at "A," passes through the passage "B" to the small chamber "C" where it divides and part goes to feed the pilot burner "D," the remainder passing through the passage "E" into the gas chamber "F," as indicated by the arrows. Here the pressure of the gas forces the diaphragm "G" downward until the tension on the lever "H" is such that it is pulled away from its seat "S," when the gas escapes from chamber "F" through passage "I" to the burner "K" where it is ignited by the pilot "D" and the flash produced. The outlet port "S" being considerably larger than the inlet port "E," the pressure on diaphragm "G" is reduced and lever "H" goes back to its original position and the operation is repeated. The end of lever "H" is magnetized so that there is no dragging in the closing or opening of the valve at "S." The frequency of the flasher per minute is regulated by changing the position of frequency level "L."

The illuminant in the A G A system is acetylene, the brilliant white light of which makes it specially suitable for day and night signals for railway and highway purposes. The acetylene is dissolved and stored in seamless, drawn steel containers which are made in two sizes, of 225 and 275 cu. ft. capacity. These containers are tested to a pressure of over 700 pounds to the square inch and the pressure of the gas, even when containers are fully charged, is only a fraction of this.

The containers are filled with a substance of about 80 per cent porosity, known as the A G A porous mass. This mass is saturated with acetone, a liquid possessing the property of being able to dissolve or absorb 250 times its own volume of acetylene at a pressure of ten atmospheres. As the containers are charged with a quantity of acetone amounting to 40 per cent of their own volume, these containers will store 100 times their own volume of acetylene when charged to a pressure of 10 atmospheres or 150 pounds.

For the A G A highway danger signal a container 12 inches by 36 inches is used, which when fully charged contains 225 cubic feet of gas and weighs 225 pounds, when empty it weighs 210 pounds. The highway danger signal lamp is 5 feet long and 9½ inches high.

GRADE CROSSING SIGNAL.

HIGHWAY SIGNAL.

A G A DANGER SIGNALS

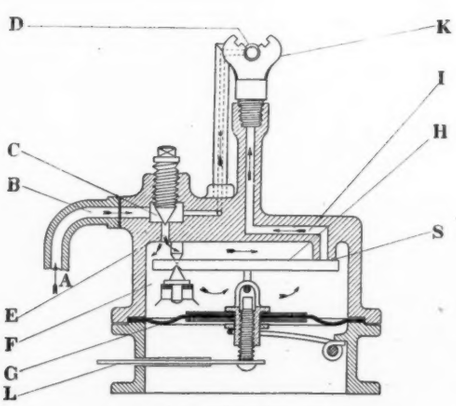
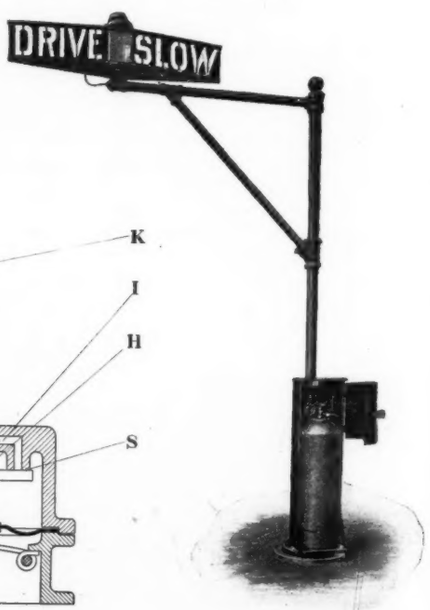


DIAGRAM OF MECHANISM FOR FLASHING.



HIGHWAY SIGNAL.

The flasher, which is located in the center, illuminates the transparent lettering, which is 8 inches high on the sides, and at the same time produces the flashes. In the highway danger signals the posts are of 3-inch wrought iron pipe. The focal height of light above the ground in both types is twelve feet, but it can be made to suit requirements. The lamp is bolted to the top of the post or bracket and the container is placed at the base of the structure as shown in the illustrations. The lettering on the lamp can be altered as desired.

On account of the small gas consumption of the A G A signals, and the moderate cost of gas, these lights are generally allowed to burn night and day. The following figures indicate the cost of maintaining one of the highway danger signals: With a light characteristic of 1/15 seconds light and 14/15 seconds dark, or 60 flashes per minute the burner alone consumes 0.28 cu. ft. of gas per day. To this is added 0.33 cu. ft. consumed by the pilot-flames giving a total daily gas consumption of approximately 0.6 cu. ft., thus:

Container	Capacity of Container	Gas Consumed, 24 Hours	Will Run on One Charge
12" x 36"	225 cu. ft.	.6 cu. ft.	300 days.
12" x 44"	275 cu. ft.	.6 cu. ft.	365 days.

In these figures a liberal allowance is made for reserve gas, to take care of temperature changes. Containers may be recharged with gas at the following charging plants: Atlanta, Ga.; Bound Brook, N. J.; Moberly, Mo.; Aurora, Ill.; East Deerfield, Mass.; San Francisco, Cal., and Toronto, Canada.

The grade crossing signal is operated on the same general principle. In the railway grade crossing signal also, the 12 inch by 36 inch container is used. The acetylene container, pressure gauge, pressure regulator and high pressure piping are protected in a sheet-iron housing. The housing is fastened by iron clamps to the base of the post supporting the crossing danger sign. At the top of the housing a door is provided which can be securely locked, thus protecting its contents from meddlesome trespassers. The base of the housing is arranged so that the container cannot be removed without first unlocking the door. The total weight of the equipment is about 400 pounds.

The lamp, however, is not set in the sign, but in front of it, illuminating the lettering on the arms with a white light and flashing a red light in the opposite direction. This may be had with an electric magnet, which in case of disarrangement in either track or local circuit, is released and causes the flasher to operate instantly providing a light on the side of safety. Without this magnet, the flasher operates continuously.

The illustrations show the straight post and bracket type highway signals, the grade crossing signal and a diagram of the flashing device. These signals are made by the A G A Railway Light & Signal Co., Elizabeth, N. J.

ADJUSTABLE MANHOLE FRAME.

Of New Design to Allow for Changing Street Surface.

City engineers and other officials in charge of street construction and maintenance have long realized that manhole structures are an important factor in the condition of the street surface. Officials having control of sewers and other conduits having manholes have found that the character of the street surface affects the safety and life of the manhole frames and covers. Where a manhole cover is

DANIELS ADUSTABLE MANHOLE FRAME.

higher than the surrounding pavement, the continuous impact of vehicle wheels coming down from the cover, tends to injure the pavement, forming a focus for wearing. The protrusion of the cover itself spoils the surface. On the other hand, there is a danger that a particularly heavy vehicle may break the frame and cover if they are exposed. A structure so placed is always subject to uneven and unnecessary wear.

These considerations, involving both the usefulness of the pavement and that of the manhole structure, have led to the design and development of the Daniels adjustable, collapsible manhole frame. This is so constructed that the frame may be lowered so as to be in proper relation to the changing street surface, without disturbing road materials.

The manhole is also a source and subject of difficulty during change of grade, paving construction or repairing, or resurfacing.

This frame consists essentially of two parts, separated by rings, the number of which may be varied to change the height. The upper member of the frame is made to telescope with the lower portion. A part of the retaining wall is made of the solid iron rings, having the same circumference as both the lower section and the upper flange where the covers rest, which are inserted between the upper flange and the lower member. The upper section of the frame may be lifted, a ring removed and the frame replaced, occupying the space left by the ring.

The traffic load is carried by the rings. The grooves between the telescoping members secure rigidity sufficient to prevent canting or tipping of the upper member. The ribs on the outside of the top member sustain the demountable wall against any crowding of the road material. At the time of rebuilding the street all the rings are returned and the top of the frame is at its original level.

Two rings are placed in the recess, one one inch and the other two inches wide—giving three inches (one inch at a time) of range of adjustment. Rings of lesser width may be used.

The frame is made for a standard cover 24 inches in diameter with a clear opening of 22 inches for a ladder or basket. The two frame pieces weigh from 260 to 275 pounds, not including the cover. The two rings weigh about 50 pounds.

The accompanying illustration shows two views of the frame—one as it appears put together and one showing the upper section lifted. This frame is made by the Daniels Road Oiling Company, 171 Westchester street, Providence, R. I.

INDUSTRIAL NEWS

Cast Iron Pipe.—Government prices remain constant, but there is a tendency to cut about $2 a ton on 6-inch and $1.50 on 4-inch where business is competitive. Quotations: Chicago, 4-inch, class B and heavier, $57.30; 6-inch, $54.30. New York, 4-inch, class B and heavier, $58.35; 6-inch, $55.35; 3-inch, $65.35. Birmingham, 4-inch, class B and heavier, $52; 6-inch, $49; class A $1 extra.

The Trussed Concrete Steel Company, Youngstown, O., has changed its name to the Truscon Steel Company. In its early days, years ago, the company devoted itself exclusively to reinforced concrete, introducing many new reinforcing products such as the Kahn Bar, Floretyles, etc. For many years, however, the activities of this organization have expanded far beyond the concrete field so as to include a large variety of steel products. Prominent among these might be mentioned the steel windows so widely used in building work, metal lath, pressed steel joists, all-steel buildings, inserts and other specialties. In the highway field the company is favorably known for Kahn armor plates, installing devices, road mesh and curb bars for concrete pavements.

In selecting a name embracing all its present activities the company follows the trend of popular suggestion. For years the company has been gen-

erally known by the name "Truscon"—a simplified abbreviation of the longer name. For this reason "Truscon Steel Company" has been selected as the new name of the company. Aside from this simplification of the name of the Truscon Steel Company, there has been absolutely no change in the company, its organization or management in any way. Representatives, locations and everything about the company are identically the same. The plant and general sales offices are at Youngstown, Ohio, and the company has representatives in principal cities.

The Walter A. Zelnicker Supply Co., St. Louis, Mo., has recently secured the services of G. W. Bichlmeir, who prior to his association with the Zelnicker Company was connected with the supply departments of the Missouri Pacific and Kansas City Southern Railway Companies, as well as having been secretary-treasurer of the W. L. Sullivan Machinery Company. Mr. Bichlmeier is connected with the Zelnicker machinery department.

The Permutit Company, manufacturing water softening and water rectification apparatus and for several years past located at 30 East 42nd street, New York, announces its removal to 440 Fourth avenue, New York, where after March 15 the entire top floor will be occupied by its offices.

Raising Hogs on City Garbage.

The National Serum Co., So. St. Paul, Minn., whose business primarily is the making of anti-hog-cholera serum, has gone into the business of raising hogs, having contracts with the cities of St. Paul, Minn., and Waterloo, Ia.; also several feeding stations outside of Minneapolis, from which town it buys the garbage after it has been delivered to the incinerating plant. The city of St. Paul collects the residence garbage and delivers it to the hog farm at a certain price per ton. The company also has a number of other feeding stations near St. Paul, in which it uses garbage bought direct from hotels and restaurants.

The price that the company pays for garbage depends upon its quality and length of its contract. Waterloo receives the highest price for its garbage because it has given the company a five-year contract and delivers at the feeding pens all of the garbage of the residence district and of the hotels and restaurants. The United Disposal and Recovery Co., of Chicago, which has an arrangement with the city for collecting garbage in Chicago, will deliver it to feeding pens where hogs will be furnished and cared for by the National Serum Co., the two companies dividing the profits.

The company states that its success in raising hogs on city garbage is due to experience in determining the quality of garbage used for food and maintaining the sanitary conditions in both feeding pens and sleeping-quarters. It states that no public market has made any discrimination between corn-fed hogs and those raised by this company. The company is open at all times to form contracts with any city having a population of 35,000 or more.

Manufacturers' Motor Truck Committee Aids Government.

With a view to aiding the Government in breaking the present nation-wide freight congestion, a Motor Truck Committee of the National Automobile Chamber of Commerce has been appointed for constant service in Washington. Christian Girl, director of production, Military Truck Division, Quartermaster Corps, U. S. A.; Hugh Chalmers, Automobile Industries Committee, and Roy D. Chapin, chairman, Highways Transport Committee, explained at the recent convention of motor truck manufacturers in New York that the importance of the motor truck was constantly increasing, not only as a war factor, but as a great and immediately available means for dealing with the freight congestion. The committee as organized includes George M. Graham, Pierce-Arrow Motor Car Company, chairman; Windsor T. White, president of the White Company; M. L. Pulcher, general manager of the Federal Motor Truck Company; David Ludlum, president of the Autocar Company, and D. C. Fenner, Mack Motor Truck Company. This committee will work largely with the Highways Transport Committee, which has charge of the responsible task of diverting short-haul traffic from railroads to the highways to relieve railroad and terminal congestion and restore normal distribution. It will also be available to all other departments of the Council of National Defense or of the War Department for any service it may be able to render, and will give to manufacturers of motor trucks all over the United States such assistance as they may call for. Temporary headquarters have been taken in the Ouray Building, Eighth and G streets, N. W., Washington, D. C.

PERSONALS

(*Continued from page 233.*)

versity, from which he was graduated with the degree of A. B. in 1879. Then he took a course in the Stevens Institute of Technology, graduating as an engineer. He served as park commissioner and tax commissioner, and was also one of the commissioners who settled the long standing boundary dispute between the states of New York and New Jersey. He was also very active in state military affairs. He was appointed Commissioner of Public Roads in 1911 by President Wilson, when the latter was Governor of New Jersey. The Bergen, the first screw propeller ferryboat, was designed by Colonel Stevens. This vessel is still in commission, and operates between Hoboken and New York. That invention marked a distinctive departure in the construction of such vessels, and one which proved so satisfactory that all other ferry lines adopted the patent. Many other inventions of a mechanical nature are to his credit. In 1910 Colonel Stevens placed his property and business in the hands of trustees, arranging that he should receive an income of not less than $3,600 a year and not more than $6,000, and making provision for different members of his family. A litle more than a year ago Colonel Stevens was appointed a member of the state highway commission by Governor Edge. He gave up the duties of this office when he was called to Washington.

PROBLEMS CITIES ARE STUDYING WITH EXPERTS

Roseville, Cal., is to construct a BRIDGE, plans for the structure being in course of preparation by the engineer, A. Girvan.

A SEWERAGE SYSTEM is to be built by Porterdale, Ga. Plans for the improvement have been completed by the J. B. McCrary Co.

Blythe, Cal., is to construct SEWERAGE and WATER SYSTEMS. A. P. Campbell is the engineer chosen to prepare plans for the improvement.

A WATER SUPPLY SYSTEM is to be built by De Witt, Ill., from plans to be prepared by the engineer engaged, W. D. Warren.

Norfolk County, Braintree, Mass., is to construct APPROACHES to a BRIDGE. The consulting engineers for the work are the firm of J. R. Worcester & Co.

A new WELL is soon to be drilled by Eudora, Ark. The consulting engineer for the work is Xavier A. Kramer.

STREET IMPROVEMENTS are to be made by Tracy, Minn. The engineer for the work is John W. Shaffer.

Houston County, Caledonia, Minn., is building three BRIDGES and rebuilding one. The engineer for the improvements is G. A. Ralph.

Meadville, Pa., is to build a SEWAGE DISPOSAL PLANT, and has retained the engineering firm of Chester & Fleming to prepare plans and specifications for the improvement.

Millard County, Deseret, and Sevier County, Monroe, Utah, are to make extensive DRAINAGE IMPROVEMENTS. The engineers for the projects are the firm of Caldwell & Richards.